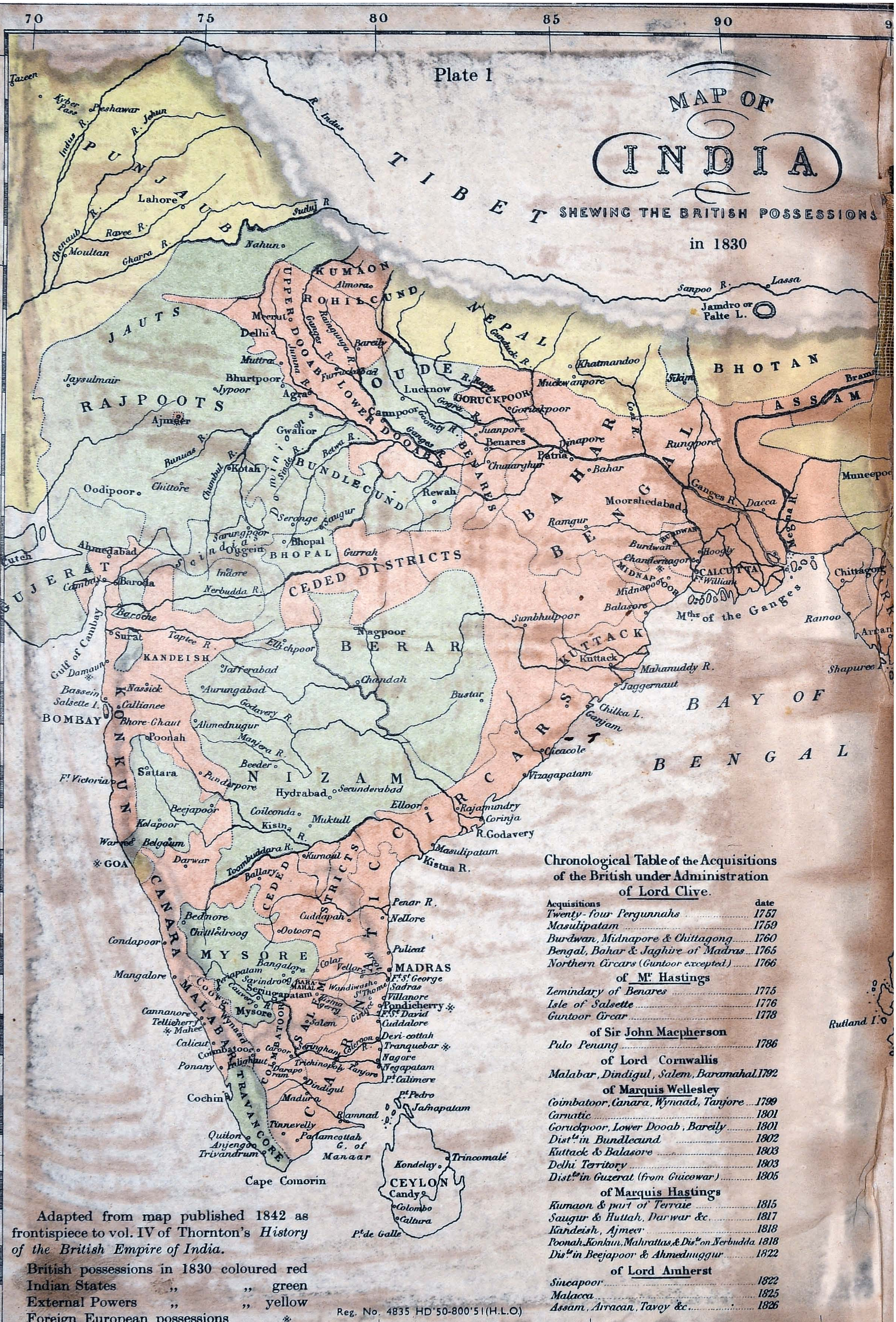

Chronological Table of the Acquisitions of the British under Administration of Lord Clive.

Acquisitions	date
Twenty-four Pergunnahs	1757
Masulipatam	1759
Burdwan, Midnapore & Chittagong	1760
Bengal, Bahar & Jaghire of Madras	1765
Northern Circars (Guntoor excepted)	1766
of Mr. Hastings	
Zemindary of Benares	1775
Isle of Salsette	1776
Guntoor Circar	1778
of Sir John Macpherson	
Pulo Penang	1786
of Lord Cornwallis	
Malabar, Dindigul, Salem, Baramahal	1792
of Marquis Wellesley	
Coimbatoor, Canara, Wynaad, Tanjore	1799
Carnatic	1801
Goruckpoor, Lower Dooab, Bareily	1801
Distts. in Bundlecund	1802
Kuttack & Balasore	1803
Delhi Territory	1803
Distts. in Guzerat (from Guicowar)	1805
of Marquis Hastings	
Kumaon & part of Terraie	1815
Saugur & Huttah, Darwar &c.	1817
Kandeish, Ajmeer	1818
Poonah, Konkun, Mahrattas, & Distts. on Nerbudda	1818
Distts. in Beejapoor & Ahmednuggur	1822
of Lord Amherst	
Sincapoor	1822
Malacca	1825
Assam, Arracan, Tavoy &c.	1826

Adapted from map published 1842 as frontispiece to vol. IV of Thornton's *History of the British Empire of India.*

British possessions in 1830 coloured red
Indian States " " green
External Powers " " yellow
Foreign European possessions *

Reg. No. 4835 HD'50-800'51 (H.L.O.)

HISTORICAL RECORDS OF THE SURVEY OF INDIA 1815 to 1830

MADRAS RECORD OFFICE
24 SEP 1955
MADRAS

VOLUME I	18th Century		Published 1945.
VOLUME II	1800–15		„ 1950.
VOLUME IV	1830–43	George Everest	In Press.
VOLUME V	1844–61	Andrew Waugh	Under preparation.

VOLUME III

Published 1954

PRINTED IN INDIA

Jawud from the South.

From route survey through Mālwa, 1818 [86].

Copied in Surveyor General's Office, 1829, by Marcellus Burke.

Reg. No. 4836 HD '50-800'51

Printed at the Survey of India Offices (H. L. O.)

HISTORICAL RECORDS OF THE SURVEY OF INDIA

Volume III
1815 to 1830

Collected and compiled by
Colonel R. H. PHILLIMORE, C.I.E., D.S.O.,
(late Royal Engineers and Survey of India)

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TRIGONOMETRICAL CONTROL

One of the great objects for instituting a general office of survey was that...a uniformity of result might be obtained, and a definite prospect (however distant) of accomplishing the survey...on satisfactory principles. ... The operations of the Great Trigonometrical Survey must...be assumed as the undisputed ground of Indian Geography [194].

BLACKER. 22–12–23.

PROFESSIONAL HONESTY

It has been said...that when experienced observers, after taking all the pains and precautions in their power, find themselves embarrassed by discrepancies for which they cannot account, they are on the point of making some important discovery ; at any rate...they may, by making a fair disclosure, enable others...to do so [176].

HODGSON. 1820.

It only remains to admonish the young surveyor to be distrustful of himself and of his instruments, and not too confident when he finds his operations agree with a surprising closeness, but to examine all, and when he finds his discrepancies not to conceal them, but patiently to investigate their cause, and repeat the work till he is satisfied. Young observers think they are always right, but not the more experienced [201].

HODGSON. 21–11–21.

ADMINISTRATION

I am an advocate for all these works, but let it be...on a regular system of subordination [329].

MACKENZIE. 12–9–18.

VR:8 E4
N50.3

The parties once set in motion should persevere on one undeviating plan, without interruption by other employment or duty ; by such a system alone the design and its expense may be finally terminated within a reasonable time [99].

MACKENZIE. 14–12–15.

SURVEYORS

It is a fixed principle with me that labour and meritorious exertions ought to be well paid. Work well and pay well [352].

MACKENZIE. 30–1–19.

You have now enjoyed a recess from active duty of six months, and it therefore becomes the more necessary that you should exert yourself to the utmost in accelerating the progress of the survey. Every surveyor is expected to be constantly employed in the duties of the survey exclusively, and during the favourable season to devote his every hour, and his every thought, to it, and to it alone [200].

PETER GRANT. 18–10–27.

INDIA

All things in India are undergoing a change, and the ideas of the inhabitants are gradually altering ever since I can recollect ; it must needs be so in peaceable times of long duration, such as this country has not known before this out of mind [339].

EVEREST. 10–8–32.

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MADRAS

ADDENDA & CORRIGENDA, VOL. I

Supplementary to lists on pp. vi and 305 of that volume, and pp. v to xiii of vol. II.

Page xvii *between* Besson *and* Bion *insert*
Bhuyan *Anglo-Assamese Relations 1771–1826*. S. K. Bhuyan. Gauhati, 1950.
xix col. 1, above *Land Revenue* insert
Lancaster-Jones *Catalogue of the Collections in the Science Museum, South Kensington. Geodesy & Surveying*. E. Lancaster-Jones. London, 1925.
xx South Kensington *to be italics, as also full 2nd line of title ; 3rd line to read in roman* Constable. London, 1921.
45 at end of note 4, insert *IO Cat.* (549–78).
58 at end of note 1, *insert* ; survd. April–May 1799 *IO Cat.* (226) [II, pl. 5].
63 at end of note 4, *insert*, Maps, *IO Cat.* (104).
75 at end of note 12, *add* ¼-inch map by Gerard, GBO. Lib. C 1.
79 note 6, *after* 1781, *insert* xv (39–50) ; (lxxi, 87).
80 at end of note 6, *insert* ; Bhuyan (97, 287).
at end of note 11, *insert* ; Bhuyan (51–433).
82 at end of note 1, *insert* murdered Jan. 1796 ; Bhuyan (433).
at end of note 6, *insert* Bhuyan (29) ; *JASB*. IX. 1840 (826).
102 at end of note 10, add ; *IO Cat.* (51).
106 at end of note 4, *add* ; survey in 8 sections, *IO Cat.* (125).
188 note 4, for *writter* read *writer*.
189 line 16, *for* yon *read* you
199 note 7, 201 ns. 1 and 3, *for* South Kensington *read* Lancaster-Jones.
238 note 10, *for* dressé *read* dressée.
250 at end of note 1, *insert* ; rival schemes discussed, *JASB*. III, 1834 (413–7).
265 at end of note 4, *add* but in letter dated Surat 28–3–95, Reynolds refers to his "present" appt. of SG.
311 note 4, *for* indentity *read* identity.
313 note 9, for *ts* read *its*.
332 under DAVY, line 2, *for* 1784 *read* 12–6–84, aged 39.
after home *insert* MI. Glouc. Cath.; heart bur.

Page
332 in cloisters, MI.
insert new line 4, Son of Wm. Davy, King's Sgt.-at-law.
337 under GOLDINGHAM, line 2. *for* d. 1849 *read* d., Worcester, 7–1–49, aged 83.
338 col. 1 *insert* new line 9, FRS.; Portrait by John Smart, 1808. [II, IX; IV, pl 22].
under HARDWICKE, line 2, *for* b. *c.* 1756 *read* bapt. 2–10–55.
enter new line 4, Son of John Hardwicke of Darlaston, Staffs.
after botanist *enter* FRS. 1813. ; FLS. ; FRAS.
line 5, *after* Hodson *enter*, II (387) ; IV (638 EE) ; Portrait presented to RS., *Phil Trans.* 1828 (appx. p. 7).
345 under KYD, line 5, *for* Capt. *read* Lieut.
line 6, *for* nephew *read* cousin.
line 12, *after* Hodson *enter*, II (613); III (730, 810). Portrait by John Smart [II ; pl. 19].
352 under MALLOCK, line 2, *before* visited *enter JASB.* XII, 1843 (542); Under orders of Henry Vansittart,
after 1764 *insert* in an unsuccessful attempt to purchase diamonds [359] ; *line 3 delete* and.
359 under MOTTE, line 16, *after* 1799 [30, 39], *insert JASB.*, XII, 1843 (542–63).
363 under PLAISTED, at end of line 6, *add* Bhuyan (62).
377 at end of note 12, add *JASB*. XII, 1843 (1014) ; XIII, 1844 (xxi).
378 under REYNOLDS, col. 2, *after* line 3 *insert* Portrait by John Smart, 1810 [IV, pl. 22].
389 under TOPPING, *after* line 2, *insert* Portrait by John Smart, before April 1795 [IV, pl. 22].
394 under WATSON, line 10, *delete* of 52nd Foot.
399 line 8 of col. 1, *after* Moahmarriahs *insert ref. to new note to read* a rebel community from E. of Dibrugarh ; Bhuyan (85, 189, 254).
note 2, *for* account *read* accounts *and at end of note insert* ; Bhuyan (358–69).

ADDENDA & CORRIGENDA, VOL. II

Supplementary to list on p. xiii of Vol. II.

Page vii col 2, against 216, lines 7 and 8, *enter refs. against* Mackinnon and Macpherson, *to new notes reading* Rev. Donald McKinnon, DD., chpn. Ben. Eur.; arrd. India 1783 ; 1783–4, to Delhi and "Upper countries" to catalogue "Indostan manuscripts".
Lt Col. Allan Macpherson (1740–1816), Ben. Inf., Hodson III (192) ; with Upton's mission to Poona 1775–7 [I, 30–1].
xi col. 2, *delete 5th para* Williamson's...original drawing" *and substitute* Portrait of Michael junr. taken in Madras by John Smart before April 1795.
8th para, *delete note* pub. Geo Bell...(*DNB*).
xiii A & C., Vol. II, *against* p. 403, line 6, *for* Burne's *read* Burnes'.
xxiii *against* INDEX *for* At end *read* 459.
xxvi *above* Archer *insert*
Anne Deane *Tour through the Upper Provinces of Hindostan...between...1804 and 1814*. Anne Deane. London, 1823.
xxvii *above* Foster *insert*
Fanny Parks *Wanderings of a Pilgrim*. Fanny Parks. 2 vols. London, 1849.

Page xxvii *above* Gribble *insert*
Grey & Garrett *European Adventurers of Northern India*. C. Grey and H. L. O. Garrett. Lahore, 1929.
below Kaye *insert*
Kinneir *A Geographical Memoir of the Persian Empire*. John Macdonald Kinneir. London, 1813.
below *Koonawur* insert
Lancaster-Jones *Catalogue of the Collections in the Science Museum, South Kensington. Geodesy & Surveying*. E. Lancaster-Jones. London. 1925.
against Markham, *line* 1, *for* C.T. *read* C.R.
xxviii col. 1, *for* Partiger *read* Pargiter *in two places*.
against *RAS*(*mn*) for *Notes* read *Notices*.
col. 2, *delete whole item* South Kensington.
above Stanton *insert*
Stanley Hutton *Bristol and its Famous Associations*. Stanley Hutton. Bristol. 1907.
16 note 3 *after* 51 *insert* (8), S. part of Sagar I., March 1810, drawn by C. G. Nicholls, asst. ; ib.

ADDENDA & CORRIGENDA, VOL. II

Page
25 note 3, after (*et seq*), *insert* 6 sheets, *IO Cat.* (171, 180);
35 2nd line of *section* GANGES-JUMNA Doāb *after* 1810 *insert ref. to new note to read*
Anne Deane (139) describes grand tour by these two Comnrs., 1808–9, from Fatehgarh to Delhi and back.
36 note 2 *for* (38 *et seq*) *read* (36–9).
37 at end of note 3, *insert* White's map of NW Frontier, 16 m. to inch. MRIO. 170 (41).
at end of note 6 *add* cf. MRIO. 15 (36) *v.* 83 [*inf*].
57 note 11, *after* (480) *insert*; Grey & Garrett (34–58).
58 at end of note 5, *insert*; 160 (43).
65 at end of 5th para from bottom, *after* 59, *enter*, 271.
70 line 20 from bottom, *after* Observations *insert* ref. to new note, *to read*
60 y. later Montgomerie records that "Col. Crawford's trigonometrical survey and map still supply the most reliable data as to the position of Katmandu". *SI Records* VIII-I (7).
71 at end of note 5, *insert* with Crawford's handprinted autograph, GBO Lib. C(2).
81 line 2 from bottom, *after* Garhwal *insert ref. to new note, to read*
Gurkhas occupied Almora 1790; Garhwāl and Dehra Dūn 1803.
83 note 4, *add* Map of N. part of *doāb* and Doon valley, MRIO. 15 (36) [pl. 10].
note 7, *for* risse *read* rises.
127 at end of note 2, *insert*, triangles, 1808–9, *IO Cat.* (26).
129 1st line of 10th para, *for* Montgomery *read* Montgomerie.
134 note 2 *delete* and possibly, *changing comma to semi-colon, and in front of* 63 *inside bracket insert* 3, 4,
144 line 22, *after* Ringletobe *insert ref. to new note to read*
Wm. Tobias Ringletaube; b. 1770; ed. Halle; ordained Lutheran 1796; to India and back 1797–9; to Madras for LMS., Tranquebar 1804–6; Palamcottah 1806–7; Travancore, 1807–15; "eccentric; ... great missionary zeal; died in a sea voyage to Malacca". *The Church in Madras* (II, 387–8); F. Penny; pub. 1912.
155 note 8, Ben Regr. *to be in italics*; at end of note insert *IO Cat.* (33).
158 at end of note 7, *insert* 2 vols. 1820, *IO Cat.* (443).
173 at end of note 8, *insert v.* Morier, frpce. Malcolm's route 1801, Bushire—Tehrān—Baghdad—shewn in sketch by Rennell, Shiraz to Constantinople [II, 444 n.3].
174 note 7, last line, *before* DDn. *insert IO Cat.* (482).
176 at end of note 2, *add* svys. described with frequent dates by Macdonald; Kinneir (171–425).
177 para 4, line 1, *for* Partiger *read* Pargiter.
note 3, for BOS. *read* BCS.
180 line 27, *after* 28 *inside bracket insert* , 35, 37.
190 at end of note 1 insert *Phil Trans.* 1822 (408–30).
191 line 19, *for* establishment *read* established.
194 at end of 2nd para *for* 201 *read* 261.
216 line 32, *for* prerfect *read* perfect.
221 note 5, *for* 47 *read* 46–7.
223 line 13 from bottom, *after* Troughton *insert* [191 n.2], *and delete ref. and note 6.*
230 note 8, *read* Aurangābād
232 note 3, *for* South Kensington *read* Lancaster-Jones.
249 *note 4* Ben Regr. *to be italics.*
254 at end of note 1, *insert* Both chains and the scale are now in Survey Museum at Dehra Dūn.
264 line 13 *for* sets *read* set.
note 6, *for* cviii *read* 1818 (486).
269 note 5, *after* (53) *insert* , copy drawn 1831 from original of 1806.
270 note 9, *for* 10–4 *read* 9–14.

Page
276 note 7, *for* ib. *read* MMC.
282 at end of note 1, *insert* MRIO. 15 (8, 9) shew part of Oudh including Lucknow.
284 note 6, *before* 85 *insert* 76 (1, 2);
322 line 15, *read* useful.
352 *under* Rossenrode *for* His son *read* Two sons.
against BURKE, line 7 from bottom, *after* Surveyor General *insert* [303]. Son of Francis & Margaret Burke; m., Seringapatam, 7–2–07, Sophia Fulham.
354 at end of para 5, *after* Falour *insert* [80].
373 col. 2, *against* Div. *read* Division.
385 col. 2, line 8 from bottom of CHRISTIE note *for* Persion *read* Persian.
386 under COLEBROOKE, Henry Thomas, line 12, after *DIB.* add *RAS* (*mn*), IV (108).
387 col. 1, line 18 *for* writen *read* written.
389 at end of note 6, *add* and d. 1837.
pl. 19 under Alexander Kyd, last line of note, *for* STREET *read*, LONDON.
393 col. 2, line 4 from bottom, *for* 000 *read* 314.
394 col. 1, line 9 from bottom, *for* 248–9 *read* 247 n.4.
395 col. 2, line 33 from bottom, *read* Gibraltar.
396 col. 1, *under* DUNN, *line 8 from bottom, after* Snow *add*, who d., Brighton, 9–10–76, aged 71.
397 col. 2, under FRANCKLIN, line 9, *read* Westminster.
399 col. 2, *under* GARRARD, *line 2, add* MI.
at end of line 7 add; their son Wm., Lieut. Mad. Engrs., d., Ooty., aged 26, 2–10–36; MI.
400 col. 1, line 16 *delete 1st word* which
402 under GOLDINGHAM, line 3 from bottom of col., 1 *for* d. 1849 *read* d., Worcester, 7–1–49, aged 83.
col. 2, end of line 3, *for* 1830 *read* 1832
line 10, *delete* junr. *and after* 1808 *insert* [IV, pl. 22].
at end of line 7 from bottom, *insert ref. to new note, to read* cf. *JASB.* II, 1833 (380–1).
403 *under* GRANT, line 1, *read* Philip.
line 2, *for* 1744 *read* 1784.
line 3, *after* Persia *add* MI. Barrackpore.
line 5, *after* (318) *add*, IV (638 BB)
under GRINDLAY, *add new last line*, Asstd. James Wyld in preparation of 16 m. map, pub. 1847; BM. Map Room, 7–B–61.
under HARE, line 3, *for* 1780 *read* 1798.
at end of note 5, *add*; remembered by villagers 30 years later, *JASB.* XIII, 1844 (702).
404 col. 2, line 4, *after* Perron *insert ref. to new note to read* Grey & Garrett (53–6) shew that Hearsey had no capacity for leadership.
405 at end of note 4, *add*; This estate of 36 villages lay nr. Rikhikesh, *pargana* Chandi [pl. 9] Williams (197–8); the Hearsey family estate Hathibarkala, 3 m. N. of Dehra, was acquired by S of I. over 100 years later.
407 at end of last line of page, *after* [pl. 10], *insert ref. to new note to read* Fanny Parks (247–8) visited Bhadraj 20 y. later, and found "a large stone on which is chiselled 'Lady Hood' 1814". The PA. told her that Lady Hood "only sent a man to chisel out her name and that of Colonel B[arton]. ... She never visited the place in person" [III, pl. 5 n.].
410 *under* KATER, line 8, after *DNB.* insert *RAS* (*mn*), III (155); Stanley Hutton (280–1).
col. 2, line 27 from bottom, *after* Greenwich, *insert Phil Trans.* 1828 (183–239).
411 col. 1, at end of line 2 *add* (257–89)
at end of line 5, *add*; also 1829 (331–8); 1830 (359–81).
under KNOX, at end of para. 2 *after* 191 *add* –2
416 *under* LENN, *at end of 2nd line, insert* MI.
under LETHBRIDGE, *1st line, add* Mad. Inf.
417 *under* LOCKETT, *at end of 2nd line add* MI.

ADDENDA & CORRIGENDA, VOL. II

Page

418 under MACARTNEY *add a new line 5,* Blunt (13/39); Hodson, III (109).

under MACDONALD, *last two lines of page, for* but no record...has been traced, *read* under which name he pub. his *Geographical Memoir of the Persian Empire*, London 1813.

419 line 11 of col. 1, *after* geography *insert ref. to new note, to read* His *Geographical Memoir*, gives details of the various routes of Malcolm's officers [176 n.2]; see also *History of Persia*, by Watson, and another by Clements Markham.

at end of 4th para, *after* to come. *add* Elsewhere he tells that during the attack his Portuguese servant, "losing his equilibrium, was precipitated under the belly of the animal [riding camel], and getting entangled amongst his legs was...tossed like a football for several yards" Kinneir (243).

at end of last para, *after* Bushire *add* new para *IO Cat.* (485); 40-m. *Map of Countries lying between the Euphrates and Indus*, pub. London, 1832.

422 1st line of 3rd para, *for* 1903 *read* 1803.

428 *under* MACMURDO *line 3, for* "Arrasseer" *read* nr. Adesar *and delete ref.*

line 10, *for* AGG. in *read* PA.,

delete note 3.

430 col. 2, line 26, *for* down *read* dawn

431 col. 1, line 4, *for* profer *read* proffer.

433 *under* NELTHROPP *3rd line, after* Chitaldroog, *add* MI.

under NICHOLLS, *insert new line 2,* d. New Hampton, Middx., 11-12-64.

above para beginning 1808 *insert new para.*

MRIO. 170 (39), survd. Thornhill's Channel, sw. of Sagar I., as asst. to Cudbert Thornhill, Master Attdt. 1807.

442 *under* SINCLAIR, Charles, *line 2, for* Nov. 1852, *read* Bath, 20-11-52; MI. Lansdown.

col. 2, 2nd line from end of SMITH, *after* to an inch *insert fresh line* 1823-9, svy. and construction *doāb* canal, E. of Jumna.

at end of note 6, *add JASB.* II, 1833 (116).

444 at end of 4th para, *after* broad *add ref. to new note* cf. Morier (128).

at end of note 1 *add*; Route of mission by Sutherland faces Morier (68).

note 3, after *DNB.*, *insert* Sec. to Harford Jones, 1807-9, *and before* 2 vols. *insert* 1 vol. 1812, with maps by Rennell and Sutherland; 2nd edn.,

446 *under* TICKELL, at end of last line of col. 1, *after* canal. *add* 1821-7, Supt. Delhi canals.

448 *under* TROYER, col. 1, at end of 2nd para *after* ASB. *add*, Registrar & Examiner, Calcutta Lottery.

at end of 3rd para *after* 20-3-35. *add* Settled in Paris.

col. 2, *under* WALPOLE, line 3, *for* 29-1-94 *read* 21-9-04.

at end of note 2 *add* cf. ib. III (118-23); V (784).

452 *under* WARREN, col. 2, line 10, *after* family, *insert ref. to new note, to read*

pr. on this return journey enquired at Cape for infn. re La Caille's meast. of arc; *MRAS.*, I, 1825 (257); Everest to CD. 3-9-21.

line 15, *for* Lambon *read* Lambton.

456 *under* HENRY WHITE, *above last line, insert* MRIO. 156 (60), May 1825, svy. of route S. of Prome on Irrawaddy, beautifully drawn.

Page

459 *against* Akbar: II, *after* Delhi *delete* from *and after* 1806 *insert* -37;

460 *against* Bamboos *after* 210 *insert*, 217,

against Bessel, after *Ency Brit.* insert *RAS(mn)*, VII (199).

461 *against* Bird, Wm., *delete* 145, and *for* 144 n.2 *read* 145 n.2,

against Borthwick, *after* 1808, *insert* kd. in action Ganjam;

against Burke, *for* 1828 *read* 1829

462 *against* Chains *for* 204, 206 *read* 204-6.

463 *against* Compass; survg. *for* 191 *read* 200.

against Coorg *delete* 216.

against Copland *for* 144 *read* 143.

against *Coss for* 220 *read* 200.

against Crawford *for* 1779 *read* 3-6-1778; Blunt (161/593);

against Degree, *after* 3, *insert* 215.

464 *against* Delhi, *after* Feroze Shah *for* about AD. 1350 *read* 1350-88 *and shift* 23, 58 *to follow* 1806 *in next line.*

after 65 *insert* 67 n.2,

after Akbar II *delete* from *and after* 1806 *insert* -37 *and after* 389 *insert* n.6.

against Dickens *for* d., Meerut 1808 *read* 1763/4-1808.

against Duncan *before* xii *insert* Blunt (168/614);

465 *against* Feroze Shah *for* Emperor of Delhi 1350 *read* 1305-88.

against Foster *for* b. 1863 *read* 1863-1951.

467 *below* Hickey, *insert* Hill, Thos. (1786-1846), asst. survr., Madras, 141-5, 163, 351.

against Himālayan Dists. *after* 6, *insert* 84,

468 *against* Kaitah Cants. *for* 40 *read* 50.

against Khōnds *for* 22 *read* 25.

after Kishen Singh *insert* Rai Bahadur (1850-1921).

469 *against* Lloyd, Geo. *after* auth. *insert* d., Thebes, Egypt, 10-10-43.

against Logarithms *for* 126 *read* 128.

against Longitude; by Lambton, *for* 240, 259, 263 *read* 215, 240-1, 259-63.

against Macdonald, *line 3, for* J. *read* James Somerled *and for* at MMI. 1815-6 *read* (1792-1843).

470 *against* Macpherson *for* 1800 *read* 1799.

against Measuring Rods *delete* 217.

471 *against* Military, *line 4, for* 292-3 *read* 292.

against Morier *for* 1780 ? *read* 1782 *and for* auth. &... Persia, 1807-9; *read* Diplomatic Service; *JRGS. XIX*, 1849 (xxxviii).

472 *against* O'Halloran *after* 1843), *insert*; Ben. Inf.; Kt. 1834; GCB. 1841.

473 *against* Perron after *DIB. insert*; Blunt (45/136),

against Planetable *for* 126, 128 *read* 127-8 *and delete* 322.

against Postal Services *delete* 358.

474 *for* Ringletobe *read* Ringletaube *and for* of Tinnevelly 1808 *read* Wm. Tobias (b. 1770).

475 *against* Scale, *line 3, for* 85 *read* 285.

against Smart *delete* junr. *and* after *Ency Brit.* insert *DNB.*

476 *against* Thomas *for* 1756 ? *read* 1755/6.

477 *against* Troughton *for* 253 *read* 252.

against Valentia *before* 406 *insert* 392.

ADDENDA & CORRIGENDA VOL. III; Page xvii

PREFACE

This third volume brings to a close the pioneer and patchwork period of our survey story. There was now a single department under one Surveyor General of India, but it was not till 1823 that the trigonometrical survey came under his orders, and it was longer yet before he exercised any close control over the surveys of Bombay. It is still necessary to arrange the narrative presidency by presidency, for each had its own separate establishment, with different regulations, and different scales of pay. Each presidency had its own survey organization, following its own pattern, regardless of what went on in Bengal where, it might be said, there was hardly any pattern at all.

This volume records the passing of two great surveyors, Lambton, the Father of Indian Geodesy, and Mackenzie, the first Surveyor General of Madras and of India, and the pioneer of ordered topographical surveys. It tells of the sound practical work of Hodgson, learning from every year's experience, and the all too brief appearance of Valentine Blacker, the Surveyor General who insisted on the priority of the Great Trigonometrical Survey beyond all challenge, making possible the eventual establishment of "one uniform system" of regular surveys as dreamed of by Mackenzie. It tells of the hard years of apprenticeship served by George Everest, which enabled him to take firm control from 1830, directing the Department for the next thirteen years, and setting the course that it was to follow for the next half century.

Of these five great surveyors Mackenzie was the only Engineer, Lambton and Hodgson were Infantry officers, Blacker a Cavalry man, and Everest a Gunner. It is not generally recognized how few of the early surveyors of India came from the corps of Engineers.

The period 1815 to 1830 saw a wide expansion of British rule and of land to be surveyed. The Nepāl war had opened up the mountain provinces to the upper Sutlej. The Marātha war had cleared central and western India of the *pindāri* pest, and the war with Burma had brought the surrender of Assam, Arakan, and Tenasserim. In the train of topographical and geographical surveys, there followed the special revenue surveys, so essential to sound administration.

It is hoped that this Volume III may issue from the press sometime during 1953, and that the printing of Volume IV may then be put in hand. This fourth volume covers the period 1830–43, during which Everest was Surveyor General and Superintendent of the Great Trigonometrical Survey. A start can then be made on the sorting and arranging of the mass of material that has been collected for the fifth period, that of Andrew Waugh, 1844 to 1861. Amongst the more interesting stories of this period will be the discovery and naming of Mount Everest—the printing of the first postage stamps of India—and the first survey of Kashmir. Many correspondents have urged that the story should be carried on with the same full detail, even should this entail breaking the fifth period into two volumes, but consideration should perhaps be given to a reader who found the first two volumes "tedious", not having mastered the gentle art of "skipping".

In writing of geodetic and revenue surveys for professional record, much technical matter has to be included that will hardly be appreciated by the average reader. The tiresome details of revenue survey touch moreover on an important aspect of sociology, the relations of a Government with the tillers of the soil, who, in an agricultural country such as India, contribute largely to its wealth. The civil officers of the British *rāj* were pre-eminently occupied with this complicated subject. They inherited the systems of *zamīndāri* and *jagīrdāri*, or landlordism, under which the holders paid fixed rental to Government, or no rent at all, whilst they drew all they could from the cultivators. It is only now, more than 150 years after the introduction of the "permanent settlement" of Bengal, that the Government

of the Indian people has set out to sweep away the whole system of landlords and *zamīndārs*. In other areas where the revenue settlement was revised periodically, more and more reliance was placed on the professional surveyors, who worked in close co-operation with the settlement officers, till elaborate cadastral surveys were introduced to show the holdings of every cultivator in the smallest detail. The development of these surveys must be of the greatest interest to those now responsible for land revenue administration.

Attention is called to the departmental crest on the title-page. The opportunity was taken in 1947 to make suitable changes to the crest that had been first introduced in 1883. After various small changes this was redesigned by Sir Edward Tandy in 1924 in the form that appears on the title-pages of volumes I and II. The main features comprised a map of India encircled by a belt with the name of the department, surmounted by the Tudor crown of England, and supported by the names of Lambton and Everest, and the dates 1767 and 1823.

To adapt this crest to modern conditions, the crown is now replaced by the Asoka lions of the Indian Union, and the latin tag by a sanskrit motto. The names of Rennell and Lambton represent the founders of Indian Geography and Geodesy, with their dates, 1767 and 1800. The name of Everest, with his year of succession 1823, has been dropped. He was not a founder, but a very great builder.

Though the bulk of these Historical Records comes from departmental sources I wish to thank my kind friends both in India and England who have helped me with information that seemed beyond my reach. I wish specially to thank the staff of the National Archives of the Government of India, and the Records Department of the Commonwealth Relations Office in Whitehall. For the domestic details of the biographical notes I am mainly indebted to Major Hodson.

The printing and making of the volume have been carried out with the utmost patience and care by the Printing Office of the Geodetic Branch at Dehra Dūn, and the maps and portraits have been beautifully reproduced by the Map Publication Branch of the Survey of India at Hathibarkala. Special attention is called to the tail-piece on page 345, which was taken from the faded cover of an old Manual of Surveying.

By a happy coincidence there was published last year a biography of our great Surveyor General, Colin Mackenzie, written by a fellow Scotsman.

GULMARG.
JULY 1953.

R. H. PHILLIMORE.

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It has been found better to bind plates 17 and 18 in reverse order.

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Page	
15	line 5, *for* Walter *read* William.
39	line 2 from bottom, *read* Sūrkanda
43	note 6, *before* (lv) *insert* I,
44	line 10, *for* over *read* nearly
45	halfway down page, *read* borderland *as one word.*
64	line 8 from bottom *read* Nongkhlao.
83	line 11 from bottom *read* Attaveessy.
	note 10 *for* 22–4–18 *read* 22–4–16.
98	line 4, *move ref.* 1 *to end of line to follow* rest.
	note 1, *for* 66 *read* 16.
102	line 11 from bottom *delete* to the Cape.
112	line 14 from bottom *for* bean *read* been.
122	at end of 3rd para from bottom *after* country *insert* [83].
123	para 6, *read* Tulluckwarra *in two places.*
128	at end of 2nd para. from bottom *insert ref. 6 to new note to read* from Jopp, 28–12–26, BoMC. *and renumber refs. and notes 6 and 7.*
136	note 3, *delete* Richard, father of *and for* 52 *read* 51
145	at end of 5th para. from bottom *for* 52 *read* 51.
179	para 6, line 2, *between* Puissant *and* Biot. *insert* comma.
183	*section* BURMA, *line 4, for* Venie's *read* Vince's *and give ref. to* new-note to *read* Samuel Vince (1749–1821), auth. of *A complete system of Astronomy* in three 4to. vols., 1797–1808.
191	at end of para. 6 *before* 190 *insert* 94.
	line 3 from bottom *read* COLĀBA.
220	line 2 from bottom, *against* Owen *enter ref. to new note, to read* Capt., later Adm., W. F. W. Owen, RN., in ch. of " ill-fated " expn., " dreadful sickness and mortality ", 1822–6, to svy. S. and E. coasts of Africa and shores of Madagascar; Findlay (36–8, 316–7).
243	n.2, and 254 line 16, *read* Gāwīlgarh.
244	at end of 3rd para. *after* feverish *add* [404].
267	note 6, Danger-field, *omit hyphen*
396	line 3, *read* perseverance
447	*under* FALLOWS *line 10,* read *RAS* (*mn*) italics
451	*under* GERARD, *line 7 for* 1795 *read* 1793
459	*under* HODGSON, *as new line 2, insert* Ben. Inf.
462	*under* HYDE, *insert new line 3,* Ml. S. Park St. cem.
	under JACKSON, *line 3, insert* Ml. S. Park St. cem.
463	note 1, read *IO Cat.* italics.
464	line 10 from bottom, *delete* ref
465	col. 2, line 27 from bottom, *for* ed. at *read* from
467	note 9, for *IGR. read I. GR.*
473	note 1, line 3, *change stop to comma before* barrister
483	*under* MALCOLM, *line 8, inside brackets, before* 443, *insert* II,
508	*under* Van HEYTHUYSEN, *line 9, read* Mary

References to MS. Records & other Abbreviations

A D C. .. Aide-de-Camp
A G. .. Adjutant General
A G G. .. Agent to Governor General
A S G. .. Assistant Surveyor General
B to CD. .. Bengal Letter to Court of Directors
B C S. .. Bengal Civil Service
B G C. .. Bengal General Consultations
B G O. .. Bengal General Order
B J C. .. Bengal Judicial Consultations
BM Addl MS. British Museum, Additional Manuscript
B M C. .. Bengal Military Consultations
B Pol C. .. Bengal Political Consultations
B R C. .. Bengal Revenue Consultations
B Rev Bd. .. Bengal Board of Revenue
B S A L. .. Bengal Service Army Lists, MS.; C R O.
B S C. .. Bengal Secret Consultations
B T C. .. Bengal Territorial Consultations
Bd. .. Board
Ben./Eccl./Wills. Bengal/Ecclesiastical/Wills/C R O.
Bio. .. Biograph/ical/y
Bo. .. Bombay
Bo to CD. .. Bombay Letter to Court of Directors
Bo C S. .. Bombay Civil Service
Bo G O. .. Bombay General Orders
Bo J C. .. Bombay Judicial Consultations
Bo M C. .. Bombay Military Consultations or Diary
Bo Pol C. .. Bombay Political Consultations
Bo R C. .. Bombay Revenue Consultations
Bo S C. .. Bombay Secret Consultations
Bo Surveys .. Bombay Survey Correspondence
Brit Assn. .. British Association
C-in-C. .. Commander-in-Chief
CD to B/Bo/M. Court Despatch to Bengal/Bombay/Madras
CD Misc. .. Court Miscellanies, C R O.
CI. .. Central India
CJ. .. Chief Justice
C P. .. Central Provinces
C R O. .. Commonwealth Relations Office
Cad PP. .. Cadet Papers
Cert. .. Certificate
Ch Sec. .. Chief Secretary
Coll/r/g/n .. Collect/or/ing/ion
Com/Corr. .. Committee/of Correspondence
Comn/r. .. Commission/er
DDn. .. Dehra Dun/Survey Records, now at NAI.
D G O S. .. Director General, Ordnance Survey
D L R. .. Director of Land Records, West Bengal (Records now at NAI.)
D S G. .. Deputy Surveyor General
Dep. .. Deputy
Dept. .. Department
Dist. .. District
Div. .. Division
E. .. East
E I/C/Ho. .. East India/Company/House
et seq. .. and following
Ex Engr. .. Executive Engineer
exbt. .. exhibit No.
Fdbk. .. Fieldbook
Fin. .. Finance
Ft Wm. .. Fort William
GBO/Comp/Lib. Geodetic Branch/Computing Office/ Library/Dehra Dun.
GG/in C. .. Governor General/in Council
G O. .. General Orders
G T S. .. Great Trigonometrical Survey
Gov/r/t. .. Govern/or/ment
H C Reports .. House of Commons Reports Committee, 1831–2; Vol. IX (254 *et seq*); PRO.
H E I C. .. Honorable East India Company
H M S. .. His Majesty's Ship/Home Misc. Series, C R O.
I O. .. India Office (Maps or Records); now C R O.
ib. .. the same
Inf. .. Infantry
inf. .. below
J A G. .. Judge Advocate General
Jud. .. Judicial Department
L F E. .. Typescript biography of Geo. Everest by his son, Lancelot Feilding Everest
Lt Govr. .. Lieutenant Governor
M. .. Memoirs or Journals, Survey of India
M C S. .. Madras Civil Service
M G O. .. Madras General Orders
M M C. .. Madras Military Consultations
M P C. .. Madras Public Consultations
M R I O. .. Map Record & Issue Office, Survey of India
M R O. .. Madras Record Office
M R S. .. Madras Revenue Selections
MS. .. Manuscript
M Rev Bd. .. Madras Board of Revenue
Mad. .. Madras
Magte. .. Magistrate
Memo. .. Memorandum
Mil. .. Milit/ary/ia
Misc/L R. .. Miscellaneous/Letters received; C R O.
n. .. footnote
N. .. North
N A I. .. National Archives of India, New Delhi
N W P. .. North West Provinces of Bengal
P R O. .. Public Record Office, London
P R I O. .. Personal Records, I O.
P W D. .. Public Works Department
passim .. here and there
Pol. .. Political
Progs. .. Proceedings
Pub/n. .. Pub/lished/lication
Pres/dt/cy. .. Presid/ent/ency
Q M G. .. Quartermaster General
qv. .. which/whom/see
ref. .. reference
Regns. .. Regulations
Resn. .. Resolution
Rev. .. Revenue/Reverend
S. .. South
S G. .. Surveyor General
S G O/S P. .. Surveyor General's Office/Salary Bills
S of I. .. Survey of India
S P G. .. Society for Propogation of the Gospel, London
S T S. .. Superintendent, Trigonometrical Survey
sd. .. signed
Sec. .. Secretary
(*sic*) .. thus; as printed
(*sup*) .. above
T S. .. Great Trigonometrical Survey; Ms. Professional Report/Tower Station
Terrl. .. Territorial
U P. .. Upper/United/Provinces, Bengal
v. .. see
V M. .. Victoria Memorial Hall, Calcutta
V P/in C. .. Vice-President/in Council, Bengal
viz. .. that is to say
W. .. West
W P. .. Western Provinces of Bengal

Dates: 22nd August 1817 or 22–8–17. Editorial Insertion: [...].
Number of page, consultation, or paragraph: (286).
Reference to page/plate of this volume [286]/[pl. 8]: of earlier volume [II, 286].
Reference to Survey of India Map: 72 E/12: *v.* Key, vol. II, pl. 24.

FURTHER ABBREVIATIONS; Page 420

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A & N Mag. — *Army & Navy Magazine* (periodical). London.

Annales de Chimie — *Annales de Chimie et de Physique* (periodical). Paris.

Anne Deane — *Tour thorough the Upper Provinces of Hindostan, ... between...*1804 and 1814. Anne Deane. London, 1823.

A S B Cent. Rev. — *Centenary Review of the Asiatic Society of Bengal.* Calcutta, 1885.

As A R. — *Asiatic Annual Register* (periodical). London.

As J./As Int. — *Asiatic Journal/Asiatic Intelligence* (periodical). London.

As R. — *Asiatic Researches* (periodical). Calcutta.

As Soc J. — *Journal of the Asiatic Society* of London (periodical); later *Royal.*

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Bo Gaz. — *Gazetteer of the Bombay Presidency.* Bombay. 1877.

Bo Geo Soc/J/P. — *Bombay Geographical Society/Journal/Proceedings* (periodicals).

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Surveyed by Alexander Gerard, 1818, for Board of Commissioners, for revenue purposes [22-3, 157], and drawn by Morgan Dove Blandford, assistant surveyor, on scale two miles to an inch.

Names and sites, Mussoorie and Landour, inserted much later, these stations not existing before 1827.

CHAPTER I

GENERAL NARRATIVE

Notable Events — Bengal — Madras — Bombay — Revenue Surveys — Great Trigonometrical Survey.

THIS volume extends from May 1815 when Colin Mackenzie was appointed Surveyor General of India, to October 1830 when George Everest took over as both Surveyor General and Superintendent of the Great Trigonometrical Survey.

During this period the map of India was considerably changed by military and political events. The incessant agression of *pindāri* marauders from Mālwa and Bundelkhand as far as Guntūr called for military action in 1816, and led to the Marātha war of 1817–8 and the downfall of the Peshwa of Poona and Appoo of Nāgpur. Persistent encroachments by the Burmese led to the war of 1824–6, the British occupation of Assam, alliance with Manipur, and the surrender by the King of Ava of Arakan, Martaban, Tavoy, and Tenasserim.

Wide tracts were thus opened for the advancement of geography. The close of the Nepāl War in 1816 led to firm and lasting friendship with the Gurkhas, and their withdrawal to the east of the Kāli River gave a glorious opportunity for exploring the sources of the rivers and fixing the heights of the snow peaks.

With the final passing of the Marātha Confederacy, and the establishment of treaties with princes and chiefs who had remained friendly during the war, surveyors could now work freely through the jungles of central India, and the uplands of the western Deccan and Mālwa. Under the lead of Elphinstone and Malcolm the Bombay Government became definitely map-minded.

The campaign in the Assam valley provoked a keen search for the source of the Brahmaputra, which produced strong evidence that it came from the Tsangpo of Tibet. Surveyors penetrated through Cāchār and Manipur to Ava on the Irrawaddy, whilst the advance of the main army from Rangoon allowed a careful survey of the river, though it was never safe for surveyors to stray far afield. More was accomplished round Amherst and Moulmein where the country remained undisturbed by the war.

But work was not confined to the exploration of new territories. Madras surveys were reorganised by Mackenzie under three main parties, one for Travancore and the south peninsula, a second for the Nizām's territories, and a third for the Northern Circārs.

Revenue surveys started in Bombay before 1812 were extended into Gujarāt, and a large staff of revenue surveyors was employed in Bengal and the Upper Provinces, where it was eventually decided to make no further extension of permanent settlement.

From 1st January 1818 Lambton's trigonometrical survey, now reaching beyond the limits of the Madras Presidency, was transferred to the control of the supreme government, and designated *The Great Trigonometrical Survey of India.* At the same time, Lambton, who was now over 60 years of age, was given two assistants, Henry Voysey as surgeon and geologist, and George Everest as surveyor. After the close of the Marātha war, he carried his central arc northwards into Berār but died on his way to Nāgpur early in 1823. Everest continued the Great Arc of triangulation across the Narbada to Sironj, but was so crippled by fever that he had to take leave to England in 1825, and did not return till five years later.

In 1822 the Directors decided to start an Atlas of India to cover the whole country on the quarter-inch scale, and called on the Surveyor General to send home reductions from all surveys considered fit for incorporation. The sheets were engraved in London as material became available, and formed the standard map of India for the next eighty years.

The surveys lost two great men by the deaths of Colin Mackenzie and William Lambton. Of their successors, Hodgson was an experienced surveyor who gave a good start to the revenue surveys of the Upper Provinces. Valentine Blacker had much to do with maps as Quartermaster General of the Madras Army, and during his short time as Surveyor General established the Great Trigonometrical Survey as the only sure foundation for future surveys and the new atlas. George Everest was to prove a worthy successor to Lambton.

BENGAL

The survey of the Himālayan tracts evacuated by the Gurkhas was put in hand before the end of 1815, a few months before the signing of the final treaty of peace in March 1816.

Hodgson left Sahāranpur with three assistants and finding no suitable site for the measurement of a base-line based his triangles on astronomical observations. He started by a general reconnaissance of the hills, through Sirmūr, Sabāthu, and Simla, to Kotgarh in the Sutlej valley. Fixing the position of prominent peaks, he returned over the high passes into the Tons basin and back to Sirmūr, where he made the Chaur peak his principal station of observation. His assistants who had started detail survey all resigned during the year as they found their small allowances did not nearly meet their high expenses.

During the winter he moved down to the plains, established a station at Sahāranpur, and then worked eastward through Rohilkhand to Bareilly, fixing his positions from the snow peaks already cut in, and sketching as much of the hills as he could see. Early in 1817 he met Webb who had started an independent survey of the Kumaun hills. During the spring months he worked up to Jamnotri to locate the source of the Jumna, and then crossed over to the Bhāgīrathi to Gangotri, the reputed source of the Ganges, being joined on his way by James Herbert, his new assistant.

They both got away to military duty for a few months at the end of 1817, but on his return Hodgson found himself too unwell to take an active part in the survey, and left most of the observations to Herbert. He resigned in October 1818 and, having convinced himself that astronomical observations alone did not prove a satisfactory basis for his triangles, left Herbert to measure a proper base-line on the ground.

Herbert devoted the cold weather of 1818–9 to the measurement of this base-line, and, after connecting it with the triangulation, found satisfactory results at last. He spent the rains of 1819 at the pleasant hill station of Kotgarh, fifty miles north-east of Simla, and the next three months in the upper Sutlej valley beyond. He was later joined by Thomas Oliver and on his transfer to Calcutta left him to complete the work by June 1822.

Webb completed his survey of Kumaun towards the end of 1821. His first reports on the heights of the snow peaks, which included those of Nanda Devi and the western giants of Nepāl, created a sensation and some scepticism in Europe, but his critics were satisfied on the publication of professional details.

During the struggle against *pindāris* and Marāthas most of the survey in the Bengal Presidency outside the Himālayan area was concerned with revenue administration, the settlement of boundaries, or the construction of roads. Revenue surveys became of increasing importance, and by 1822 had been started seriously in Sylhet, the Sundarbans, and the Upper Provinces.

In 1824 the outbreak of war against Burma diverted most of the revenue surveyors to the exploration of Cāchār, Assam, Arakan and Burma, in support of the troops. Pemberton was the leading surveyor on the Cāchār front, and he soon pushed forward into Manipur, where he continued for several years in a semi-political capacity, surveying the frontier with Burma, and running a line down to Ava.

Bedford, Wilcox and Burlton did most of the survey up the Brahmaputra, reaching Pasighāt on the Dihāng, and the Brahmakund fifty miles east of Sadiya. On Bedford's withdrawal in September 1826, Wilcox was specially commissioned to discover the source of the Brahmaputra. Abor tribesmen stopped his journey up the Dihāng, but he satisfied himself by several measurements that the Brahmaputra derived the great volume of its water through the Dihāng which appeared to flow directly from Tibet. After several journeys into the Mishmi Hills, he and Burlton travelled eastward into Burma, and in May 1827 reached the western branch of the Irrawaddy near Putao, or Fort Hertz. The small flow of water in this branch gave strong evidence against the suggestion that the Tsangpo of Tibet made one with the River of Ava. Both surveyors were laid up with fever for several months after this adventurous journey, and Wilcox then withdrew to Calcutta to work up his maps.

Very little work could be done by the surveyors in Arakan owing to the ravages of fever, difficulties of communication and transport, and the impossibility of working without escorts.

The most valuable work in Burma was done by Peter Grant, who had just returned from leave to the Cape, where he had spent most of his time with the Astronomer Royal. He landed at Rangoon in July 1825, armed with first-class instruments, and took observations for latitude and longitude at Rangoon, Prome, and other places up the Irrawaddy, whilst his assistants made detailed surveys. After the campaign was over Browne and Trant made independent surveys across the Arakan Yoma to the west coast.

After the signing of peace in February 1826, Grant moved to Moulmein, where he took more astronomical observations. He made three short trips up the Salween and surveyed the rivers of Amherst to the Siam border. By the end of 1827 he was saturated with malaria, and had to withdraw to Calcutta. He hoped to regain health by a sea voyage but died at sea in April 1828.

The close of the Marātha War left the southern and western frontiers open for further surveys. During the long minority of the young chief of Nāgpur, the Resident took the opportunity to have a good one-inch survey made of the greater part of the country, that was carried through between 1823 and 1830 without reference to the Surveyor General. The Quartermaster General maintained a number of surveyors rated as A.Q.M.G.'s, who extended military surveys into the sparsely habited territories of Nāgpur, Mālwa and Rājputāna.

Of the surveys controlled by the Surveyor General, Franklin carried on in Bundelkhand intermittently till 1820. Under Hodgson's direction Johnston completed the survey of Bhopāl between 1819 and 1823, and Alexander Gerard spent two seasons from 1822, and a short one in 1827, surveying further north, towards Nimach and Jaipur. In 1828, a more extensive survey was started by Boileau from Allahābād; he ran traverse through Cawnpore to Delhi and Agra, incidentally correcting an error in the longitude of Cawnpore which had persisted since that fixed by Reuben Burrow. He then worked westwards towards Bharatpur, whose chief had at last submitted to British arms. In planning these surveys, Hodgson aimed at a system of co-ordinated and intersecting traverse lines, controlled by regular astronomical observations; continuous triangulation was out of the question.

MADRAS

Mackenzie's appointment as Surveyor General of India found him just returned to Madras after four years absence in Java and Bengal. He applied himself at

once to the reorganization of the Madras surveys on "one uniform system", following the principles he had worked out in Mysore and the Ceded Districts.

He planned four field parties which were later reduced to three, each under an experienced military surveyor, and each with a number of country-born assistants, and a writer or interpreter. Survey was to be based on Lambton's triangles where available, but elsewhere the party was to measure its own base-lines. Lesser triangles were to be observed as a rule by the military surveyor in charge, and the detail filled in by theodolite traverse or plane-table. Survey was on the one-inch scale, each party reducing its own work to the quarter-inch scale season by season. Assistants were found for these new parties by closing down the separate district surveys.

The party which had just completed the survey of Sonda under Garling was now moved to Coorg under Conner. Garling raised a new party for the Nizām's territories, and Ward a third for Travancore. There was some delay in forming the fourth party intended for the Northern Circārs. A start was made at the end of 1815 by sending a small detachment north of the Kistna, whilst Mountford took another to Guntūr, which had been left unfinished by the closing of the Military Institution. Mountford had to be withdrawn to take over the Madras office, and it was not till 1820 that an officer was found to extend survey north of the Godāvari, beyond the last of Lambton's triangles.

Survey was to cover all detail required for military and civil needs, with a statistical and descriptive memoir of the country. Mackenzie insisted on steady progress strictly according to programme. All parties were to be under the control of his representative at the Presidency.

Mackenzie was so engrossed with this work at Madras that he did not move to Calcutta till July 1817. He left Riddell in charge, with a small drawing section that was fully occupied in maintaining records, copying maps for the Court of Directors, and subject to the Surveyor General's approval compiling any special maps the local Government might call for. He kept a tight control from Calcutta, and exchanged letters with Riddell at least once a week. On Riddell's death in 1818, Mountford was brought in from Guntūr, and the post was up-graded to Deputy Surveyor General in 1823. Mountford died in 1824, and was succeeded by Duncan Montgomerie. Both officers were good administrators, and did much to maintain a high standard of survey and mapping, even though they were never able to inspect the units in the field.

Ward set out from Madras in July 1816 and, picking up the assistant surveyors in Dindigul, started them on work in Travancore, where the country was mountainous, heavily wooded, and full of fever. He was joined early in 1818 by Connor's party from Coorg, and between them the Travancore survey was completed by the end of 1820. Ward then finished off the Dindigul survey, and moved to Coimbatore to survey the Nīlgiri Hills, for now that their healthy climate was appreciated there was an urgent call for maps. Ward completed his survey with heights of the plateau and its peaks by the end of 1823, and then moved down to Malabar.

He was now so saturated with fever that he had to take leave to the Cape, leaving two trusted assistants to carry on. Little progress was made in his absence, however, as both Keyes and MacMahon were continually sick, and Keyes died the following year. Ward returned at the end of 1825, a new man with a wife to look after him, and the survey went steadily forward till, early in 1830, Malabar was completed, together with the Wynād, and sound connection made with all adjacent surveys. Ward was a fine topographical surveyor, and his survey of these heavily wooded, intricate, and fever-ridden hills of the south-west peninsula was a magnificent piece of work.

Lambton had taken his triangles into the Nizām's south-eastern territories during 1815, and it was convenient therefore that Garling should start his topographical

survey in the Raichūr Circār, in the Tungabhadra–Kistna *doāb*. He started work in July 1816 with three assistants, completing Raichūr by the end of 1817 and then moving northwards. Being a master triangulator after Lambton's own heart, he pushed his triangles beyond the western frontiers, and fixed the positions of the famous ruins of Bijāpur, finding his work greatly appreciated by the Bombay surveyors working from Poona. His enterprise was rebuked by Mackenzie, who insisted that he had no right to exceed his instructions which confined him to the Nizām's dominions.

Survey was much interrupted by sickness, and the party had to retreat to Bellary each year for the rains. One of the assistants died in 1819, and Garling himself died the following year. Conner came up from Travancore, but died within a month of reaching Hyderābād. Robert Young took charge in December 1821, but after two field seasons he also succumbed, and died in July 1823. Under Crisp, another officer of the Military Institution, work proceeded steadily south of Hyderābād till, in 1825, the Surveyor General ordered the suspension of the survey so that its records could be brought up-to-date and re-arranged by administrative *circārs*, Crisp and one assistant moving to Calcutta for the purpose. The party reassembled again for field work in January 1827, but shortly after Crisp handed over to J. T. Webb. Webb took sick leave to England in 1829, and left the party to Henry Morland, in whose capable hands it continued, off and on, for nearly twenty years.

The survey of the Northern Circārs was long overdue and except for the fertile coastal fringe the country was practically unknown, as there had been none of the military activity that had opened up other parts of the peninsula. Mackenzie had hoped that Lambton would be able to provide the necessary triangulation, but his main central arc had prior claim.

After a start had been made by a party of assistants north of the Kistna, Richard Hodges took charge early in 1820 and measured a base-line near Ellore, but died shortly after. Snell, who took over in November 1820, held on for nearly 15 years, and carried triangulation and detail survey right through to Ganjam. He had many casualties among his assistants owing to the pestilential character of the fever-ridden jungles, but he nursed the party through. Montgomerie was frequently roused to fury by the slow progress made, and was convinced that Snell was a shirker, but though wide gaps were left along the western borders they were not of much political or military interest and reliable maps were produced of the greater part of the country.

BOMBAY

At the outbreak of the *pindāri*–Marātha wars of 1816 to 1818, the energies of the Bombay surveyors were mainly directed to large-scale revenue surveys. Williams, whose office as Surveyor General had been abolished in 1815, continued in charge of the revenue survey of Broach, and as senior surveyor held charge of all mapping, and continued to advise Government on survey matters till he retired in 1821.

During the war a number of officers were employed on military surveys of roads and communications, which under the enthusiam of Malcolm and Blacker were compiled into valuable maps of Mālwa and the Deccan. Soon after peace was signed Elphinstone, now Commissioner at Poona, called for a regular survey of the Deccan, which was started by James Sutherland in 1818 with three or four Bombay officer assistants and another three lent from Madras. Triangulation was extended by Jopp from the south, starting from bases provided by Garling. An independent survey of the Southern Konkan was started in 1822 by Thomas Jervis, who measured his own base-lines as well as connecting to the triangulation of Garling and Everest.

There were many changes amongst the officers of the Deccan survey, but work proceeded steadily till, with the Konkan survey, it was closed down in 1830. Sutherland was appointed Assistant Surveyor General in 1822 and promoted to Deputy the following year. On his departure to Europe in 1826 he handed over to Jopp, who held the post for the next seven years.

Neither the Deccan nor the Konkan survey was of very high standard, and both lacked the accurate control that would have been given had Everest's longitudinal branch of triangles been continued to Bombay. In 1827 Jopp obtained the Surveyor General's support for a trigonometrical survey on scientific lines, and Robert Shortrede, famous later for his logarithm tables, started triangulation from a base measured just above Khandāla Ghāt on the Bombay–Poona road. His work was not, however, in any way comparable with that of the Great Trigonometrical Survey, and was stopped by Everest's orders in 1834.

REVENUE SURVEYS

The East India Company was a commercial concern, and the Directors were immediately interested in their trading profits, and in drawing a substantial and regular income from their cultivated lands. They fully realised that a contented and hard-working peasantry was essential to the collection of land revenue, but their officers experienced great difficulty in making equitable assessments. The various indigenous systems of land measurement and valuation of crops were simple and cheap, but had no pretensions to accuracy, and were liable to the grossest forms of corruption and injustice.

After various experiments in Bengal, the permanent settlement of 1793 had been introduced with the object of avoiding future difficulties. The *zamīndars*, or landholders in possession, were to pay a fixed sum every year, based on the estimated assessment of their holdings in 1793, and Government renounced all further claims on the value of the crops. The drawbacks of the scheme were innumerable, for no provision was made for future changes of ownership, or the subdivision of holdings. There was no record of the precise limits of the lands covered by the settlement, and no provision for the assessment and collection of revenue in areas not so covered.

In Madras settlements of revenue were made district by district according to local circumstances. In most cases there was no regular land measurement, but assessments were made from old records and continued indefinitely. Alexander Read in Salem, and Thomas Munro in the Ceded Districts, had made important surveys with local Indian staff, and had introduced a trustworthy system by which a fair assessment was spread over the cultivators of those districts.

The rich lands of Bombay and Salsette islands were subjected to a meticulous survey under Thomas Dickinson and his military assistants. Dickinson not only made detailed measurements with high technical skill, but also classified the soils and crops, and assessed the revenue to be paid on each holding. The survey was commenced in 1811 and not completed till 1827.

The survey of Broach by Williams and five or six military assistants, though not on such a large scale, was nearly as elaborate. After the experimental survey of one village in 1812, the survey of three *parganas* was completed by 1817, and then extended throughout Gujarāt. Cruikshank, who took over from Williams, closed down field survey in 1827, but did not complete his maps and reports till two years later. The Directors were greatly pleased to get the detailed information provided by these surveys, but they were expensive and elaborate, and but little used by the district officers, who preferred to base their revenue assessments and collections on the ancient customs of the country.

Less elaborate surveys were started in the Deccan, somewhat on the lines of Munro's survey of the Ceded Districts, but were in some instances unsatisfactory

owing to the high rate of assessment. The most valuable was that made of Sātāra by Adams, but extended efforts made under Robert Pringle, a Bombay civilian, were the subject of continued criticism and discussion and eventually led to the valuable system worked out by Wingate, and followed by the Bombay Presidency for the next generation.

The most important of the early surveys in Bengal, following the permanent settlement, were those of the Sundarbans and of Sylhet. Reclamation of the Sundarbans, which had been abandoned soon after the death of Henckell, became a matter of some interest after 1807, and was mainly effected by cultivators who wished to extend their fields without increase of taxation. As all land that had not been cultivated in 1793 was held to belong to Government, the first requisite was a survey of the limits between cultivation and waste land, and this was the main purpose of the survey started by William Morrieson in 1811, and extended by his brother Hugh till the breakdown of his health in 1818.

In 1816 a Commissioner was appointed to ascertain how far the *zamīndars* had encroached beyond their permanently settled estates, to resume such encroachments on behalf of Government, and to settle the terms of redistribution. In 1821 Thomas Prinsep was appointed surveyor to the Sunderbans Commission, and survey proceeded continuously for the next ten years, Prinsep being succeeded in turn by Mallock and Hodges. It was during this survey that the Sunderbans lands were distributed under the serial *lot* numbers by which they are still known. The surveyor confined himself to natural features only, the *khals* or creeks which formed the *lot* limits; he was not concerned with measurement of fields or assessment of revenue.

Only 2,100 square miles of Sylhet district came under the permanent settlement, the remainder, over 3,000 square miles, being at that time uncultivated, and the property of Government. There had since been much extension of cultivation, and efforts were first made to measure this by the doubtful agency of *amīns*. In 1822 the Commissioner obtained the services of Thomas Fisher to control these *amīns* by a master survey of blocks and estates. Fisher continued this survey until 1829, though interrupted for two seasons by the Burmese war. His accurate survey of the outer limits of his blocks proved a great stimulus to the accuracy of the *amīns*, and produced valuable results without the excessive expense incurred in Gujarāt and the Upper Provinces.

It was long debated whether a permanent settlement should be applied to the districts of the so-called Ceded and Conquered Provinces, taken over by the Company between 1801 and 1806. The Directors were most reluctant to make any settlement without a better knowledge of the resources. They were much impressed by the results of Munro's survey of the Ceded Districts, and still more so by Williams' survey of Broach, and they strongly advocated the adoption of thorough surveys of this nature both in Madras and the Upper Provinces of Bengal. The Bengal Government was alarmed at the probable expense and very heavy nature of the work, and referred the question to the Surveyor General. Mackenzie was, however, far too cautious to express any definite opinion, and indeed he was not sufficiently acquainted with Bengal conditions, or the problems involved, to formulate recommendations on the subject. His health was failing, and he had lost his vigour.

After his death in 1821 Hodgson took up the question with enthusiasm, and with his co-operation Government issued instructions laying down the general principles that should guide the conduct of revenue surveys in the upper provinces, and the extent to which they should be used by the district revenue staff.

During 1822 four separate surveys were started in Gorakhpur, Rohilkhand, and Delhi; each under charge of a military surveyor, who had a military assistant, three or four country-born assistants, and the same number of *amīns*. Each party was responsible for a professional, or European, survey, entailing a base-measurement, with triangulation and traverse, and survey of main topographical features, besides administrative and village boundaries. The surveyor in charge was not

responsible for measurement of fields, or valuation of soil or crops, as in Bombay, these being left to the district officers and their Indian staff. Village maps were on the scale of eight inches to a mile, and areas of cultivated and waste land were calculated separately. The task was colossal and, as the surveyors were anxious to produce good work, progress was desperately slow considering the area that had to be covered.

The surveys came directly under the orders of the Surveyor General until Blacker took over from Hodgson in October 1823. Hodgson was then appointed Revenue Surveyor General, making his headquarters at Fatehgarh where he was alongside the Commissioners for whom the work was being carried out. On the outbreak of the Burmese war all the surveyors except those of Delhi were called off for survey with the armies, most of them drifting back to the revenue surveys before the end of 1826. On Blacker's death Hodgson resumed office as Surveyor General, and continued to administer the revenue surveys until Herbert took them over on his leaving India. By 1830 the number of parties in the Upper Provinces had increased to five, with a total of 6 military officers, and 25 civil assistants.

Government, as well as the civil revenue officers, fully recognized the great value of the survey, but were impatient at the deliberate, precise, methods followed by the surveyors. Anxious to get sufficiently reliable surveys at a much faster rate of progress and at lower cost, the Governor General, Lord William Bentinck, summoned a conference of revenue officers and surveyors at Allahābād in 1833, which led to a considerable increase of outturn.

GREAT TRIGONOMETRICAL SURVEY

By 1815 Lambton, being in at least his 60th year, had completed his triangulation south of parallel 16°, and carried his central arc up to Bīdar in latitude 18°.

For the next six years he occupied himself at Hyderābād with reports and computations. On the basis of his great arc along ten degrees of meridian, and of French and British measures, he worked out fresh values for the figure of the earth, and with these recomputed his work, not only once, but twice.

Field work was carried on intermittently by his assistants, though precautions had to be taken on account of the war. In addition to extending the great arc northwards to the Godāvari during 1817, De Penning spent several months of 1818 on secondary connections to the south.

When Everest joined at the end of the year he was, after a few months training, deputed to run triangles north and south between the Kistna and Godāvari rivers to the east of Hyderābād. Work lay through difficult hilly country, covered with dense forest. Following Lambton's regular procedure he took the field during the height of the rainy season, in order to take advantage of the clear visibility, and he and his men were overwhelmed by malaria. After a second attempt he was compelled in 1820 to take long leave to the Cape.

During his absence, triangulation of the south-east area of the Nizām's territories was completed under De Penning, and in the rains of 1821 Lambton moved out to extend the great arc to Berār. De Penning took the triangulation to within 60 miles of Ellichpur, but then had to break off as his whole party was crippled with fever. With Voysey's help Lambton measured a base at Tākarkhera, and made the necessary astronomical observations, though he was no longer capable of accurate work or prolonged exertion.

Everest rejoined from leave just as Lambton was packing up for his return to Hyderābād, and in October 1822 was given an independent task, to run a chain of triangles westwards towards Poona and Bombay, whilst Lambton closed down his establishment at Hyderābād, and set out, sick but determined, on the long march to Nāgpur where he proposed to set up headquarters for his work to the north. The journey was too much for him; he was nearly 70 years of age, and was in an

advanced stage of consumption. He died on 20th January 1823, at Hinganghāt, about 50 miles short of Nāgpur.

Everest broke off his triangulation just short of Sholāpur, and returned to Hyderābād to assume charge and to follow out Lambton's programme in carrying the great arc northwards towards Agra. During his independent operations he had worked out several improvements in technique and procedure. He had discovered and put into practice the great value of night observations to lamps, thus taking advantage of the nocturnal increase of vertical refraction. He had devised suitable lamps for the purpose, and was now able to avoid the unhealthy months of the monsoon. But he had found no panacea for the vagaries of Indian climate and disease, and was struck down with fever just as he was starting out from Hyderābād at the end of the rains of 1823. This fever haunted him on and off for the next two years, but he was a man of indomitable will, and did not give in until he had carried his triangles to a successful close at Sironj, through more than three degrees of arc. Such was his weakness that he had at times to be held up to his instruments by two of his men.

Setting out from Hyderābād in October, he deputed Joseph Olliver to carry the triangles northwards from the point where they had broken down two seasons earlier, whilst he and Voysey went forward to meet De Penning at Ellichpur. Here he accepted Lambton's measurement of the Tākarkhera base, but took particular care in connecting it to adjacent stations, and made fresh observations for zenith distance.

He now lost the services of both De Penning and Voysey. De Penning had a large family to educate in Madras, and Voysey found his salary insufficient. He had done valuable pioneer work as geologist, though his researches had not revealed any hidden causes of local attraction, the chief purpose for which Lambton required his services. His health had been badly shaken during his five years with the survey, and he died just before reaching Calcutta after his long march from Berār.

Left now with but two trained assistants, Olliver and Rossenrode, Everest carried his triangles through the difficult wooded hills and river valleys that lay north of Berār, and reached comparatively open country round Sironj, on parallel 24°, in November 1824. Here he spent three months measuring a base and making observations. He was now completely worn out and towards the end of 1825 handed over Olliver and left for England, not to return till October 1830.

The years he now spent in England were all in the service of the trigonometrical survey. The important instruments and equipment with which Lambton had started the survey were damaged and worn—the great three-foot theodolite—the zenith sector—the chains—and he was commissioned to study the latest developments in Europe, and purchase for the survey the most up-to-date and suitable apparatus that could be obtained. Making contact with the Ordnance Survey of Great Britain, besides leading scientists and instrument makers, he fulfilled his mission to such good effect that on his return to India he was able to reorganize the work of the survey, and bring its operations up to the highest standards of accuracy to be found anywhere at that period. An equally important task was the working out and analysis of the results of his observations made between 1823 and 1825, and these he published in 1830 under the title *An Account of the Measurement of an arc of the Meridian between the Parallels of 20° 3′ and 24° 7′*.

There had been much discussion as how best to employ the staff during Everest's absence. There was no officer suitably qualified who could be trusted to continue the great arc northwards to the mountains, as planned, and it was decided that Olliver should run a longitudinal series of triangles from Sironj to Calcutta, working with the best available serviceable instrument, an 18-inch theodolite. Olliver completed this by 1832, working through the difficult, unhealthy, country of Bundelkhand, Baghelkhand, and Chota Nāgpur. Coming down to the flat plains of Bengal he was faced by the same problem that Lambton had met on the

coast of Tanjore, but without the advantage of high pagodas to give visibility above the serried tree-tops. Help was found in the single line of telegraph signalling towers that had been recently built between Calcutta and Chunār, and these were supplemented by specially built towers such as were later used for carrying the great triangles across the Ganges valley.

Time marches on, and the story of another epoch has been told. 1830 is a most important date for the Indian surveys, for it marks the triumph of Lambton's great conception, the subordination of all survey work to the one master survey "ascertaining the great geographical features of a country upon correct mathematical principles". When Everest became Surveyor General he gave the Great Trigonometrical Survey first priority, and was determined to push it forward with all the means at his disposal, and to allow no survey to be initiated on any other basis.

CHAPTER II

BENGAL & THE UPPER PROVINCES

Chittagong & Sundarbans, 1815–8 — Calcutta — Bengal Rivers — Marine Surveys — Orissa, 1818–21 — Nepāl Frontier, 1816–20 — Oudh & Gorakhpur, 1817–20 — Sahāranpur & Dehra, 1815–9 — Delhi Canals — Allahābād to Agra, 1827–8 — Agra, 1829–30 — Roads.

THOUGH it was now more than forty years since Rennell had completed his survey of Bengal, on scale no larger than five miles to an inch, it was only in a few districts that demands were made for better maps. Such demands came generally from district officials who wanted something in the nature of a general revenue survey shewing villages and their cultivated lands and the main features of the country. For such purposes were the surveys of Chittagong and the Sundarbans, where large areas had been opened up since the adoption of the permanent settlement. Both were started before the Nepāl war, and Cheape's survey of Chittagong was too important to be interrupted on its account [II, 19, 178].

His fieldbooks run from January 1815 to March 1817, whilst his final maps were not completed till October 1819. The survey was conscientious and thorough. His maps were plotted first on the one-inch scale, and then reduced to half-inch, quarter-inch, and finally to ten miles to an inch, all clear and full of detail[1].

The survey was to cover those cultivated tracts not included in existing surveys...for the assistance of the Revenue Department in the assessment of the lands, the measurement of which was at that time undertaken by the Assistant Collector. ...

Newly cultivated lands lie contiguous to the hills and jungle, and nearly throughout the whole district a new topographical survey is in progress of all lands lately reclaimed[2].

The map has been constructed from a series of routes surveyed by compass & chain, excepting the southern parts of the district...where the perambulator was used. ... These routes have been carried along the edge of the hills and jungle, and into the cultivated recesses and corners, so as to define the boundary of the cultivated tracts ; likewise along the banks of the rivers, along the whole of the roads and, where the cultivated tracts are of sufficient extent, ... intersecting the country so as to form a series of diagonals, averaging a square 2 or 3 miles each side.

The survey has been corrected by latitudes...likewise by bearings...taken to the peaks of hills when visible. ... The longitude of Islamabad [Chittagong] has been taken from Major Rennell's map [I, 152]. ...

The survey of the Naaf River was attended with a good deal of difficulty and fatigue, in consequence of only small uncovered boats being procurable. ... The Kurnufoollee River has been surveyed...by means of a rope 1,000 feet long, sustained on the water by floats, and the position of Rangamatty determined by bearing & angle of altitude of Dolphin, the distance being deduced from the height of this hill having been previously determined. ... Sundeep Isd. [is] not surveyed, but laid down by bearings from Seetacoon Hill[3] [I, 23].

Cheape made no attempt to survey the wild hills to the east, but he gives a panoramic view shewing the "Blue Mountain" some forty miles distant, with bearings to individual peaks[4].

[1] MRIO. 39 (14–16) ; Misc. 6–0–20. [2] Fdbk. MRIO. M 257 ; Report, BMC. 25–10–16 (63). [3] Sītakund, 79 N/10. [4] MRIO. 39 (10) ; Misc. 20–0–19.

The passes thro' the hills being so similar to each other, it was considered a waste of time to go thro' the whole of them. ... In those the survey has been carried through, the perambulator has been used, being impracticable for the chain.

The accompanying map on the scale of 10 miles to an inch will serve to show my idea of these hills, with the course of the Koladyng River, said to be our eastern boundary [68], likewise of the nullahs running into it, the position of Arracan [68], & roads thro' it. ... Altho' the information it will convey is very limited, and I have no great opinion of its correctness, it will yet serve to show the idea the hill people and Mugs[1] have of our boundary[2].

William Morrieson had started the Sundarbans survey in 1811, and his brother Hugh carried on till called off by the Nepāl war [II, 14–5, 177]. Here again the primary purpose was to ascertain the extent of cultivation for revenue assessment [134, 139]. William had surveyed the area "between the Hooghly on the west and the Juboona and Roymungul rivers on the east", his brother making "considerable progress...from the Roymungul River eastward to the Cubberduck"[3]. When Hugh resumed survey, 1st October 1816, he reported that

nearly one half of the survey...is completed. Great difficulties arise in carrying on, ... the immense extent of jungle, the habitation of tygers and other beasts of prey, preventing the possibility of landing on almost every part of this extensive tract. The variety of tides, currents, and counter-currents, flowing from a hundred different channels, will in some measure explain the intricacy of keeping an exact log on board the vessel; indeed nothing but the most unremitting attention, with the assistance of the best instruments and constant series of astronomical observations, can conduct a surveyor through such a labyrinth[4].

He carried on with many adventures and difficulties till October 1818, when he had to close down owing to continued ill-health leaving unsurveyed a width of about 60 miles west of the Meghna[5] [7, 140].

Another survey interrupted by the war was that of the district boundaries of Hooghly, Burdwān, Midnapore, and the "Jungle Mehals", or Manbhum, started by Jackson in 1814 [II, 19] and completed by him between April 1816 and July 1817[6]. Everest remarks that though the map "gives a good delineation of the topographical features of the country", its projection and scale were untrustworthy[7].

CALCUTTA

Surveys could never keep pace with the expansion of Calcutta [II, 17–8], and in February 1816 Richard Faithful, of the Pioneers, was appointed "to correct the surveys of the suburbs...at Howrah and other places". His maps covered "Cosseepore, Barnagore", scale 100 yards to an inch, and the "Suburbs of Calcutta between Barnagore, Salt Water Lakes, etc.", scale 300 yards to an inch[8].

In the cold weather of 1818–9 a class of apprentice surveyors[9] made a survey of the botanical gardens at Sibpur, which was beautifully drawn, probably by their instructor, William Scott [19]. It shows "General A. Kyd's garden [I, 347], now the property of C. T. Metcalf, Esq."[10], on the river bank in the north-east corner, the present site of the Bengal Engineering College[11]. During 1821–2 they also surveyed Calcutta *maidān*, scale 8 inches to a mile, from Government house on the north to the jail and militia lines in Alipore on the south[12].

A survey of Kidderpore was made for the Board of Revenue by Henry Osborne [138], and he tells of difficulties from the

the great unwillingness of the adjoining owners to point out the boundaries of their own grounds, or such as they lay claim to, and the removal of the pins which I put down to guide me. ... I should much wish to have a statement of the whole quantity of ground originally taken

[1] Muhammadan people of Chittagong. [2] Report, 14–10–19, from MRIO. Misc. 20–O–19 & M 257; other fdbks. M 256–9; later maps compiled 1832, with Blake's work to north [138–9], ib. 39 (6–10), 8 m. to inch. [3] BTC. 10–5–16 (20) & BMC. 24–5–16 (119). [4] ib. 25–10–16 (63). [5] His original rough protractions on ½-inch scale, MRIO. Misc. 9–O–18, and ¼-inch reductions, Misc. 8–O–18. [6] BGO. GG. 19–4–16; map, about 1-inch scale MRIO. 38 (30–2); fdbk. ib. M 526. [7] DDn. 265 (208–17) 17–6–31. [8] MRIO. 40 (17), 45 (21). [9] Polhill, Fitzpatrick & Clayton [17 n.9, 22, 154 n.6]. [10] Chas. Theophilus Metcalfe (1785); BCS. 1800; *DNB.*; *DIB.* [11] MRIO. 49 (18); 200 ft. to inch. [12] ib. 43 (14).

to make this road. ... During the government of Lord Mornington[1]...it contained a width of 500 feet, and extended from the old Garden Reach road near Kidderpore bridge to its junction near the 5th milestone, a distance of about 2¼ miles. ... About 280 biggahs...has been distributed in various ways, of which it is necessary to render an account by my survey[2].

This survey was not completed, "the expenses having exceeded the amount contemplated by Government"[3], but Osborne published in England a "*Plan of Calcutta,* with the latest improvements", in one sheet—in a case—price 82s. 6d.

From 1820 the capable and versatile surveyor, John Schalch [II, 440–1], was employed by the "Lottery Committee" to survey the salt lakes and surroundings of Calcutta, and to prepare a plan for navigable canals connecting the Hooghly with the waterways leading to the Sundarbans, since Tolly's Nullah [I, 64, 65] could no longer cope with the traffic. He made a detailed survey, laid out the canals, and designed and constructed many important bridges. His map was engraved in eight sheets, scale 500 feet to an inch, and issued in 1825 with a "Book of Reference"[4];

Map of Calcutta...will issue from the press in the new year. Engraved by Mr. E. Le Combe, Entally. The unusual large size of the plates, and the minuteness & accuracy with which every feature of the town is inserted, excite our admiration. ... The engraving has been made from the large MS. survey executed under the immediate superintendence of the Committee of Improvement, by a gentleman of rare attainments and talents, whose delicacy we must not wound by broader allusion[5].

It is proposed to publish in Calcutta an engraved map of that city, on the best English drawing paper, 5 feet 4 inches long by 2 feet 10 inches broad, covering an area of about 20 square miles. The map will contain every street, lane, and road in the town. ... It will show every pucka building, public office, & private dwelling. ... To be ready for delivery...March 1825. Price Rs. 40, or Rs. 45 mounted[6].

There were several engraved editions on various scales, the following legend appearing on that of 1830;

Plan of the City of Calcutta and its environs, Surveyed by the late Major J. A. Schalch for the use of the Lottery Committee, and containing all their improvements, with additions from the Surveyor General's office, and from recent surveys by Captain T. Prinsep. Engraved by E. De La Combe. The publisher begs to return his thanks to Mr. W. N. James of the Surveyor General's office for the aid he has afforded in the surveys of the additions made to this edition.

Scale about 500 feet to an inch. Price per set of 4 sheets 12 rupees.

[Under the heading is *A View of the Government House, and the Houses adjoining.* No evidence as to the artist—A *bhangywala* carries two *gharas* of water in centre—an empty *ghara* lies in left-hand corner—an Indian woman stands talking to a squatting man on left edge—a *palki* with servant and 4 bearers stands by the road][7].

A reduced sketch, scale 6 inches to a mile, was printed in 1826 by Samuel Smith[8], and a later edition, scale 4 inches to a mile, with Prinsep's corrections, was issued by Tassin in 1832.

The Lottery Committee was the prototype of the modern Improvement Trust, and the profitable manner in which it raised funds was no doubt adapted from the successful lotteries run by Edward Tiretta [I, 389]. The lotteries were closed down in 1830 "for so-called moral reasons"[9].

Schalch's official designation was "Superintendent of Canals and Bridges". Accounts of his work are given in a letter to the Directors, and in a volume of *Selections from Bengal Government Papers, 1865–1904,* describing the canals;

The insufficiency of Tolley's Nullah has long been admitted. The delays and difficulties which occur in the passage...constitute a serious evil. ... Being fully persuaded that the work proposed by Lieutenant Schalch...will be very beneficial, ... we resolved that the undertaking shall immediately be commenced. ... We have...appointed...a committee under...which Lieutenant Schalch is to execute the...work, ... and nominated Captain Jackson of the Quarter Master General's Department [II, 409] to be their Secretary. ...

[1] Later Marquess Wellesley, GG. 1798–1805. [2] B Rev Bd. 21–8–21 (23). [3] CD to B. 29–10–23 (24). [4] *Ben Regr.*, 18 (17), 34 (106), Map of Country between Koolna & Calcutta, showing Canals, 12–9–21; *Imp Lib M & P.* 65 A 31 (1). [5] *Govt. Gaz.* 11–10–24; the "delicacy" of the *Gazette* would not suit the journalist of 1947 ! ! [6] *As J.* XVIII. Oct. 1824 (396). [7] A different view, from the south, appears on 1825 edn. [8] Map; NAI. Lib. [9] Hirst; Evan Cotton (175).

> Lieutenant Schalch...was accordingly appointed Superintendent of Canals in Bengal, and Agent for the preparation of Suspension Bridges, with an allowance of 1,000 rupees per mensem, in addition to his military pay & allowances and...allowance for boats and other incidental expenses. ... Lieutenant Schalch's plan and estimate appear to be the result of an accurate examination of the country, and of much careful and judicious consideration of the subject. ... To aid in the execution...we have appointed Lieutenant Taylor of the 5th Cavalry, and Lieutenant Prinsep, Surveyor in the Sundarbans, to be his assistants[1].

Schalch's scheme was

> to cut a canal from Chitpur to the old Eastern Canal, now known as the Circular Canal, on a line parallel to the Circular Road. It was completed in 1831, and the Chitpur lock was opened in 1833. ... Previous to 1810, the Eastern Canal was simply a shallow and tortuous channel between the salt lakes and Entally ; in 1810, the Eastern Canal was improved, widened, and lengthened nearly up to Circular Road.
>
> The Eastern Canal comprises a channel of communication, chiefly natural, but partly artificial, between Calcutta and Barisal ; the natural portions are the tidal channels and rivers of the Sundarbans ; the artificial portions are nearly all the results of the labours of Major Schalch.

One of the major considerations was the determination of

> the difference of level between the Hooghly and Salt Water Lake. ... Major Schalch, Captain Thomson, and Captain Fitzgerald, as well as Captain Prinsep, have left statements which do not in some respects agree. ... The Commission have adopted the levels of Captain Prinsep... inasmuch as he submitted a map of the Salt Lakes "prepared upon a very accurate and minute survey carried on by a European under my own immediate superintendence, and which may be relied on for accuracy".
>
> Upon this map Captain Prinsep has drawn a guage representing the surface level of the lake tides, and bed, in relation to certain fixed points still existing, such as the bench-mark at Chandpaul Ghaut, and the sill of the old dock at Kidderpore, ... and to the accuracy of this guage, or scale of levels, Colonel Sir Thomas Anburey, then Chief Engineer, bears favourable testimony[2].

The committee of 1865, however, preferred Schalch's levels, which were connected to the Kidderpore tide-guage [I, 347] and differed only slightly from those run about the same time by Blechynden. Schalch expressly notices that his levels agreed within half an inch with those of 1783 [I, 52][3].

Other canals "to Hoseinabad on the Jaboona River" were sanctioned in March 1823, and started by Schalch till he was called off to military service [68]. After his death Thomas Prinsep was appointed in September 1826 to carry on the work[4]. One of the schemes that was never carried out is illustrated in a map of the Hooghly prepared by Taylor in 1824, "explanatory of a plan for opening a communication between Calcutta, Diamond Harbour, and new anchorage (near Dag Creek)", which bears a note that the southern part was taken from a survey by Thomas Prinsep[5].

Amongst surveys of other town Charles Smith, of the 15th Regt. N.I., was in January 1816 allowed Rs. 400 "for surveying and drawing plans...of the cantonment of Dacca", whilst the following month James Tetley was employed to make "an accurate survey of the city of Dacca", which should contribute "as well...to the efficiency of the police, as to the proper arrangement...of the custom house choukey" Tetley received "a monthly salary of sicca Rs. 200, and an additional allowance for the establishment, ... contingencies, etc., ... amounting to about 70 or 80 rupees monthly", with theodolite, perambulator, and chain, from the public stores[6].

Later in the year Bentley Buxton, cadet of Engineers, was appointed to survey part of Dum Dum cantonments for the Military Board, being followed by Henry Osborne in 1819[7]. In 1827 William Osborne, son of Henry [12, 138], was employed by the Revenue Board on a survey of Chinsurah[8] [369].

[1] B to CD. (Rev) 30–7–23 (231–50). [2] *Ben Sel. Canals* (ii, 5). [3] probably by Mark Wood [II, vi]. [4] ib. (44–7, 90). [5] MRIO. 165 (31), 166 (11, 12) ; 170 (40), Salt Lakes with canals, creeks, and Tolly's Nullah [I, 63–5], Thos. Prinsep, Dec. 1828. [6] BMC. 15–3–16 (138). [7] ib. 27–9–16 (60) ; *Ben Regr.* 98 (281). [8] ib. 110 (416–8) ; Town & Suburbs, Hooghly, Chinsurah ; 1,000 ft. to inch ; Nov. 1826 to June 1827.

The immense floods carried down by the great rivers of Bengal are a source of perennial anxiety to this very day. From earliest times efforts have been made to control them by continuous embankments, for which surveys and estimates were frequently demanded [I, 22, 354].

During the cold weather of 1816–7, Walter Forbes surveyed "the bunds for the Rājshāhi District along the Ganges"[1] and, during 1824–5, William Fitzgerald made an extensive survey of embankments along the rivers of Jessore[2].

In 1817, George Everest, of the Artillery, was deputed to clear the rivers Ichāmati and Mātābhānga of trees, sunken boats, and other obstructions to navigation ; no survey was involved, but the ingenuity which he applied to the problem was typical of his later work in the Great Trigonometrical Survey[3]. His efforts, however, provided no permanent cure. The following year Wroughton and Blechynden made a survey of the Mātābhānga,[4] and other officers followed ;

> The obstructions had became so many and dangerous as to cause the wreck of innumerable boats, and to entail heavy losses. ... The merchants of Calcutta...petitioned that steps should be taken for remedying the evils. ... Mr. Robinson[5] was appointed Superintendent and Collector of the Matabangah, and commenced his duties in the cold season of 1819–20, and effected great improvements by clearing the channel of obstructions.
>
> He was succeeded...by Mr. May...for upwards of 20 years. ... During 1820–21, Mr. May made a careful survey of the heads of the Jellinghee and Matabangha with the Ganges adjoining, and proposed to make periodical surveys for ascertaining and recording the changes of the great river [I, 64–5 ; III, 21–2][6].

At the end of 1819 the old question of an artificial cut between the Ganges and one of its outlets near Jalangi was resurrected, and a review made of various proposals and experiments made since 1795 [I, 64]. Recent surveys and unpromising reports by Forbes and Edward Garstin were discussed, and it was resolved that

> the Superintendent and Collector must...confine himself at present to the objects of removing such accidental causes of obstruction as may from time to time occur ; of clearing particular portions of the bed ; of confining the stream in certain places ; and of making partial cuts where they may be easy of execution and defined in their result. ...
>
> Nothing can...be definitively settled without a careful survey of the various streams which intersect the delta of the Ganges. ... Government will...be glad to receive...any suggestions which may occur to Colonel Mackenzie on the subject generally of the internal navigation of Bengal, and of the means of improving it[7].

Mackenzie's health was, however, far too poor for him to advise on this difficult matter, and in June 1821 Schalch submitted a map of the rivers lying between the Hooghly and the Sundarbans, with a plan "for opening a permanent communication between the river Hooghly and the great river, through channels not likely to be obstructed" [13][8].

In 1823 Government wrote to the Directors ;

> The maps annually prepared by Mr. May furnish a highly interesting view of the workings of the river and...may enable us...to ascertain the limits to which they extend. For, great and apparently capricious as is the destruction and creation of land which occurs... each year, it seems that the progress of the river is regulated by fixed laws, and...that after certain periods it returns over the space it has already traversed, so that the bounds of it's encroachment on either bank may be traced [154].
>
> We have directed Mr. May to extend his survey to the head of the Bhagruttee, there appearing reason to think that in one season the navigation will be most easily kept open by that stream, in another by the Jellinghee, and in a third by the Matabhanga[9].

In a letter of 8th July 1825, May prophesied that unless drastic action was taken there was every prospect of the Mātābhānga becoming "at no very distant period, ... in the hot months, perfectly unnavigable for boats even of the smallest size"[10].

A set of lithographed maps known as *Prinsep's Atlas* contains 8 sheets showing the Ganges, Bhāgīrathi, and Hooghly rivers from Allahābād to Calcutta, surveyed

[1] BMC. 25–10–16 (120) & 8–11–16 (68) ; fdbk. MRIO. M 280. [2] Maps, ib. 52 (9–11). [3] B to CD. (Rev), 4–7–17 (137–46) & CD to B. (Rev), 2–5–21 (45). [4] BTC. 9–10–23 (24). [5] C. K. Robison [*sic*]; uncov. civ. ; later magte. Calcutta, where he d. 11–4–46 ; MI. Circular Rd. cem. ; maps of head of Mātābhānga R. and of Malda, 1820 *Ben Regr.* 38 (88, 133, 296) ; *JASB.* IV, 1835 (119, 177). [6] *Ben Sel.* II. 1851. [7] BRC. 19–5–20 (72). [8] Maps, MRIO. 169 (15–6) ; B to CD. (Rev), 30–7–23 (228). [9] ib. 30–7–23 (264–5). [10] B Rev Bd. 19–7–25 (41) ; later maps by May, 1827–8, MRIO. 163 (12), 169 (13).

by Colebrooke [I, 64–5 ; II, 20–3], May, and Fitzgerald [15], brought up-to-date in 1828 by Thomas Prinsep [13][1].

An account is given later of the exploration of Assam and the survey of the upper Brahmaputra [53–64]. The following account is given by Wilcox of his survey of its lower course through Bengal, between February and June 1828.

I...send you a chart of the Brahmapootra river from Gowalpara to Jamalpoor, made on my way down from Assam at Mr. Scott's request[2]. ... I found it advisable to adhere to one bank...and I soon perceived that, instead of merely correcting Rennell's map for the alterations that have taken place, I must construct one anew ; so little resemblance is now to be recognised with the former state of things. ...

Having in my former survey fixed the position of some hills in the vicinity of Goalpara, I was at no loss for some miles to lay down my stations with sufficient accuracy, and...I found my first protraction of the distance to Dooburee[3] differs but 2 furlongs from that of Major Rennell's maps ; I was also so successful as to place Bugoowa within 4 furlongs of Rennell's position. ...

From thence, as the country is open, and as I found my progress very slow in tracking, I determined to use the perambulator, and accordingly the remaining distance to Jamalpoor was measured, excepting in some impracticable places. ... The names even of some of the former villages have been forgotten, and the sites of many removed[4]. Bugawa is supposed to have been where the bed of the river now is. ... Below Burgoowa scarce any resemblance can be traced to the banks of the Brahmapootra in the upper part of its course ; instead of the long dreary tracts of impenetrable jungle, a fine open and well cultivated country extends[5].

The Surveyor General then recommended that Wilcox should make a survey of the Bramahpootra from Goalpara downwards to, and a little below, the parallel of Dacca, where several navigable streams join it. The object of the survey would be to ascertain the channel of the main river, the rival of the Ganges, and the courses and capabilities of all the navigable creeks and channels which branch from and connect it with the Ganges and other rivers, both east and west of it.

The last surveys of the Bramahpootra are of remote date [I, 19–20, 158–9]. ... For more than 30 years past, geographical research and surveying operations have...accompanied...our armies...in the North-West of India, but within a late period the Burmese War has recalled our attention to the very imperfectly known countries to the north-east, east, and south-east[6] [50]. ...

The great probability of obtaining abundant supplies of coal in the eastern districts, almost every part of which is accessible by water carriage, would render those districts of great value. ... Further, ... a knowledge of the present state and course of the Bramahpootra, of its velocity, depth, and the mass of water it rolls to the sea in a given time, cannot be deemed objects unworthy of the attention of the Government[7].

The survey was duly authorised, but could not be started before 1830 when in asking that Wilcox might be given an assistant, the Surveyor General pointed out that such great changes have taken place since the compilation of Major Rennell's map, that...it affords little or no accurate information of this part of Bengal. ...

The method pursued by Lieutenant Wilcox is that of triangulation, and filling up the details by means of the plane-table, and the trigonometrical operations, being conducted with care and accuracy, will afford data for correcting the position of many principal points in the eastern part of Bengal. ... It is very desirable that two officers should be employed, ... and in the event of the removal of the principal by sickness, or any other cause, there would be a person ready to take charge of the records, and carry on the work. It will also be necessary for Lieutenant Wilcox to measure a base-line, which is a very tedious operation, and cannot be well performed without an assistant[8].

Edward Ommanney was appointed assistant from 1st October 1830.

MARINE SURVEYS

Charles Court held charge of the Marine Surveys department, Bengal, first as Marine Surveyor and later as Marine Surveyor General, from 1812 till his death

[1] *IO Cat.* (111–2) MRIO. 166 (30). [2] Map, MRIO. 179 (9, 10) ; Jamalpur, 7 m. above Mymensingh, 78 H/13 ; David Scott, AGG. NE. Frontier. [3] Dhubri, 78 F/18. [4] cf. Colebrooke's reports on Ganges [II, 22–3]. [5] DDn. 231 (147), Calcutta, 23–6–28. [6] A similar situation to that of 1942–5 ! ! [7] DDn. 231 (175), 29–9–28. [8] DDn. 265 (56–8), 13–9–30.

in 1821 [II, 391–2], when he was succeeded by Daniel Ross whose chief assistant was John Crawford[1]. Surveys proceeded steadily along the coasts of Arakan and Tenasserim [70, 74], and much useful work was done during the Burmese war of 1824–6[2]. The surveying ship *Research*, under Crawford, was fitted with 10 guns, and took part in actions on the Arakan coast [68–70]. Ross also fitted his ship, the *Investigator*, as a man-of-war, to support the occupation of Amherst and Tenasserim [73–4].

Other marine surveys to be noticed are those of James Robinson on the west coast, where he co-operated with Jervis in 1823 [130,], and a survey in 1829 of the Makrān coast by George Brucks and Stafford Haines[3].

Surveys by other officers of the Bombay Marine are described in Low's *History of the Indian Navy*, and Markham's *Memoir on the Indian Surveys*. In his retrenchments of 1828, Bentinck ordered the marine survey department to be broken up, but Ross was allowed to continue survey of the Arakan coast till he resigned in 1833[4].

ORISSA, 1818–21

Although Sackville had spent three years from 1809 to 1812 on a general survey of Cuttack, his map was not published, and in 1816, when the country was threatened with invasion by the dreaded *pindāris*, the military commanding officer represented that he was

utterly ignorant of the boundaries or passes into the Mahratta Country, and the information furnished by the hircarrahs I employ is so vague and unsatisfactory that I can form no just idea upon the subject [I, 89, 241].

He was told that

a map of Cuttack is about to be forwarded...to the Judge and Magistrate of that district; His Lordship in Council does not consider it necessary that the expence of protracting another for the use of Lt Colonel O'Halloran [I, 384] should be incurred, and accordingly request... that officer...to refer to the map in the possession of the civil authority[5].

Throughout 1817 the country lay in the throes of a rebellion of tribesmen who rose in sympathy with the *pindāris*, with whom, however, they had nothing in common beyond a desire to rid the country of the English. The rebellion was not stamped out till April 1818, when proposals were renewed for a deliberate survey to assist in the settlement of estates, for which the Collector had asked in 1816 for a supply of instruments including "six chains, of 24 feet in length, each link 6 inches"[6]. Cuttack, it must be remembered, had not been part of Bengal at the time of the permanent settlement of 1793; it was conquered from the Marāthas during the war of 1803–5 [II, 23].

Bentley Buxton was appointed in 1818 to make "a general map of the country and its principal divisions, ... reserving for future consideration the expediency of undertaking more minute surveys of individual estates and villages"[7].

He was given the assistance of Marcellus Burke, one of Mackenzie's assistant surveyors from Madras, and started by making a survey of the town and vicinity of Cuttack. After the rains, he took up regular triangulation, whilst Burke made a detailed survey, with traverses of the main roads[8]. He was later given two apprentices to train[9].

11 miles N.E. of Balasore, 1st April 1820. The survey during the last month has been extended to the northward of Balasore. ... The deep nullahs and marshes, however, which abound in the vicinity of the coast, and which are passable only in few places, present considerable obstacles. ... The whole coast is likewise covered with high jungle extending about two miles inland; the villages are few and poor, and the scarcity of roads and supplies render this part of the country difficult of access.

[1] not to be confused with John Crawfurd, of the civil est. PWI., Java, and envoy to Ava [78]. [2] Maps of Arakan Coast by Henry Hardy, MRIO. 175 (8–11) & Chas. Wm. Montriou, ib. (13), and also John Crawford and Chas. Armstrong, ib. 171 (72), & *Ben Regr.* 550 (107). [3] MRIO. 111 (42); Markham, (11–3). [4] Low, I (400). [5] BMC. 5–7–16 (32). [6] ib. 1–11–16 (147). [7] DDn. 133 (7), 17–4–18. [8] MRIO. Fdbk. M 269. [9] Polhill & Clayton [12 n.9].

The apprentices are employed in filling up the details of particular portions, the limits of which I have laid down with the chain and theodolite[1].

About 45 miles to northward of Cuttack. 1st June. ... The rains have now fairly set in. ... I have closed the work of this season, and...am...on my way to Cuttack. The operations...of the past season have embraced...about 1800 square miles, in which a part of its northern boundary has been defined, as well as the boundaries of the Tributary States of Neelgur and Mohurbunge, and of the Chuckleh of Balasore. ... The survey...would have included a wider extent of country had not my proceedings been twice interrupted by violent attacks of sickness among my attendants, from...which few have yet thoroughly recovered. ... In January the delay was attended with much inconvenience as at that period, on account of the clearness of the weather, a favourable opportunity was lost of extending the triangles among the hills, and of fixing a greater number of remarkable points. ...

But the unhealthiness of the climate is not the only obstacle. ... The country so unfavourable to travelling; the great dearth of provisions, their inferior description and the exorbitant charges demanded for them, ... render it difficult to procure people who will accompany me into this part of the district. ... During the last season it was in my power only to carry on the triangles through the plains whilst Mr. Burke followed me with the details, using the points which I had fixed; and as this...was solely conducted by Mr. Burke, his personal aid was necessary in protracting the work and inserting the names of places[2].

Cuttack. 27th June. ... Next cold season...I shall strike off through the hills again where the triangles can be continued, ... to obtain the extent and principal places of the tributary states as soon as possible. ... I intend to take 3 or 4 months provisions for servants and sepoys from hence, and perhaps establish depots. The nature of the country is certainly against me[3].

Khoordah[4]. 23rd September. ... The heat on the 21st during most of the day I was in the palankeen was greater than I almost ever felt it, and one of my violent bilious headaches the consequence. ... There seems to be a good deal of jungle about Khoordah with a few hills, which will enable me to connect my former triangles. ... At a rough guess there appears to be about 500 villages in the Khoordah district, and many of the villages mentioned in the list were destroyed in the rebellion. ... The weather has prevented my looking much about the place, but there are, I understand, several old ruins[5]. ... I think of starting from hence on Monday, but wish first to mount the Khoordah hill to look about me, weather permitting, it being a round, long-backed, one, and covered with high thick jungle[6].

Mackenzie had come down to Puri for a change from Calcutta, and was far from well, though taking a close interest in Buxton's progress. He writes about three months before his death ;

Your plan of triangles extended from Khoordah was satisfactory to me, and I wish much you may be able to extend them so as to embrace Ganjam fort. My reason is that the positions of Ganjam and Cuttack being ascertained many years ago by an astronomer of some repute, it will be very satisfactory to have your details...confirmed by such authority. I will send you these positions...when I can lay my hands on them[7].

He was probably referring to Topping's observations of 1785–6 [I, 171].

At the request of the Commissioner the survey of Khurda was made on a large scale for revenue purposes [136], but it had to be closed in February 1821 owing to the collapse of Buxton's health and was never resumed. The following is taken from his final report ;

The survey was commenced in the latter end of the year 1818, and carried on...by...a series of triangles computed from a base...measured on an extensive plain near the village of Simleea, about 70 miles N.E. of Cuttack. ... The triangles being altogether of a secondary order, no great degree of accuracy was to be expected, although perhaps sufficiently correct for all the purposes of a common survey of a small tract of country.

The triangles were with difficulty extended through the plain country, which naturally abounded with obstacles, ... but by the close of the season were brought to...the town of Cuttack and its vicinity. Mr. Marcellus Burke...surveyed as I advanced with the triangles. ... About 600 square miles were completed in this manner during the first season. ...

The following season, commencing again at the base, I extended triangles in a northern direction, embracing a considerable tract of the hilly states of the tributary rajahs. From the facilities which the hills afforded, I was enabled to proceed more expeditiously, though the country is almost an entire expanse of hills and jungle.

[1] DDn. 147 (257). [2] ib. (264). [3] ib. (274). [4] Khurda, 73 H/12. [5] ref. Mackenzie's archæological researches ; cf. Stirling (151). [6] DDn. 147 (295). [7] DDn. 154 (123), 25-1-21.

My progress was, however, impeded by the prevalence of sickness among my people, which occasioned me to quit the hills for their recovery, and occasioned the loss of a month. The assistant Mr. Burke also...had been attacked by severe illness, and rendered incapable of resuming duty[1]. But, as substitutes, I had been furnished with two Government apprentices... from whose labours, however, I by no means derived the same aid as from...Mr. Burke[2].

In the survey of the details I found it necessary also to detach the apprentices to a greater distance than I could have wished...from the wild and barbarous nature of the tributory states and their inhabitants, the jealous eye with which they looked on all who entered their country, ... and the great scarcity of supplies.

From the early commencement of the rains in Cuttack, and their general continuance, leaving many parts of the country entirely under water, a surveyor can seldom prolong his operations in the field beyond the 10th of June, or begin them earlier than the 1st of November[3].

What with Mackenzie's death and Buxton's sickness, no use whatever was made of Buxton's survey till Everest discovered it nearly ten years later, and had it connected by the South Parasnath series. He writes in November 1831 that the papers were

left in an imperfect state at the death of Lieut. Buxton[4], and it would take some time to extricate the field books from the confusion in which they have ever since remained.

The detailed work bears appearance of great assiduity, and the triangles, as far as they go, seem to be creditably executed. They are of a secondary class; the instruments used were a common theodolite and...iron chain and, as the latter never appears to have been compared with any standard, ... doubt...attaches to the whole performance. ... In spite of this it appears to me to rank next in accuracy to the survey of Gurhwal [30–40]. ... It extends from Balasore to Juggernath[5].

I have had a rough plan constructed. ... The latitudes and longitudes of the places are not derived from the survey...and the line of coast and Calcutta, as well as everything without the boundary of the work, are put down by conjecture, so that this beautiful little detail work, though complete, or nearly so, within itself, is totally disjointed from the general atlas[6].

During the first half of 1821 and through the rains till August, William Scott with a class of eight apprentices surveyed an area from Puri to the southern end of the Chilka Lake, with a strip to the west [12, 361–2][7].

Considerable interest had long been taken in the Chilka Lake for its possible use as a harbourage. A survey had been made in 1812 by Charles Weston [II, 12], and later by George Minchin of the Bombay Marine[8], who records the depth of water in December 1820, whilst William Stephen surveyed the "outlet as it existed in January 1821, together with a view of the range of sand hills which separate the lake from the sea", and also the "outfall" into the sea[9] [II, 443].

Surveys of the Orissa roads from Midnapore and Cuttack to Puri and Sambalpur were made in 1827–8 by Robert Rose, an assistant surveyor[10].

NEPĀL FRONTIER, 1816–20

Under the treaty of Sagauli of March 1816, a stretch of foothills from the Gogra to the west border of Gorakhpur was ceded by the Gurkhas, and later transferred to Oudh[11], whilst a much longer stretch of the *tarai*, eastwards from Gorakhpur, was ceded by the British to Nepāl. During the next four years several surveyors accompanied British and Nepalese commissioners to survey and demarcate the new line.

Peter Grant surveyed the boundary with Oudh[12]; William Garden that with Gorakhpur[13]; Pickersgill the frontier with Champāran [pl. 4][14]. Peter Boileau, commanding the Resident's escort at Kātmandu, continued the survey eastward

[1] granted 12 mo. leave to Madras [360]. [2] Maps MRIO. 55 (1–3, 40, 41, 51); 56 (29). etc. [3] DDn. 196 (136–9), 13–9–21. [4] February 1825. [5] DDn. 265 (303–8), 10–11–31. [6] ib. (315–6), 17–11–31. Fdbks. DDn. 270 (5); ½-inch map, *IO Cat.* (180); 3 charts of triangles, *IO Cat.* (53). [7] DDn. 147 (202), 28–5–21; sketch, ib. (214). [8] Mdpn. 1808; Capt. 1830; chart MRIO. 177 (4). [9] Map, scale 500 yards to an inch, with an artistic sketch of the sandhills, ib. (5, 6). [10] ib. 47 (3), 133 (48); *Ben Supply Regr.* 4 (1–28). [11] Restored to Nepāl in 1859. [12] MRIO. Misc. 2–O–17. [13] Fdbk. ib. M 308; Map, ib. Misc. 5–O–17. [14] BGO. GG., 31–3–17; fdbks. MRIO. M 308–9; maps, Misc. 4–O–17; 19–O–17.

along the boundaries of Tirhut and Purnea. One of his maps shews, in a dead straight line running east by south from a point about 8 miles west of Nāthpur,

a very extensive & ancient causeway running from the hills near to the River Ganges, named 'Bheem Bound and Mujoorree Kauth', supposed to have been constructed to check the overflowings of the Koosa R., or to divide the states of the Rajahs of Gour & Simrum Gurh[1].

Boileau has left an interesting account of the decisions made by the commissioners. Unfortunately he succumbed to the cruel climate of the *tarai* in December 1818, leaving

nine unfinished copies of boundary maps, three of the north-west borders of Chumparun, and six of the frontier of Purneea...which were preparing at the time of his death, and were destined for the Government of Nipaul and the local authorities[2] [21].

The boundary of eastern Nepāl was surveyed early in 1817 by Weston, whose original map is still preserved at Calcutta, and extends into the hills some twelve miles north of Darjeeling, which name, with the spot-height 7,225, has been added in red many years later[3].

Of the few maps of Nepāl itself we have some collected by Brian Hodgson, who was Resident for many years. One of them is described by Markham as Hodgson's

physical map of Nepal, shewing the river systems, ... together with the routes obtained by Mr. Hodgson from Kathmandu to Peking ; from Kathmandu to Darjiling, and a measurement of the great military road through Nepal, from Kumaon to Sikkim[4].

There is also preserved at Calcutta a "map of Bhoti (Tibet), done at Nepal for Mr. Hodgson by a mendicant priest of Bhot in 1824"[5].

OUDH & GORAKHPUR, 1817–20

Grant's survey of the Nepāl frontier was spread out over several years, 1817–20, to suit the vagaries of the boundary commissioners. He was under the general orders of the Board of Commissioners at Farrukhābād, who employed him on the eastern and western boundaries of Oudh with the Company's districts, and on various surveys in Gorakhpur.

In September 1817 he was appointed to "survey the western frontier of Azimghur and Jwanpore, where it touches the territory of the Nawab Vizier"[6] ;

This survey was...necessary in consequence of the encroachments...made by the subjects of the Nawab Vizier on the British territories, and...to put a stop to the frequent affrays which had occurred between the landholders and villagers in the vicinity.

He was also to recommend "a more convenient and distinct boundary" between Jaunpur and Azamgarh. His survey covered[7] *pargana* Atroulia[8],

inhabited principally by a race of people called Pulwars, ... of a turbulent disposition, and less civilized than the other inhabitants. ... The affrays originating from their violence and oppressive exactions under the plea of a proprietary right to lands adjoining the frontier rendered it...expedient to adopt some measures...of putting an end to the disorders[9].

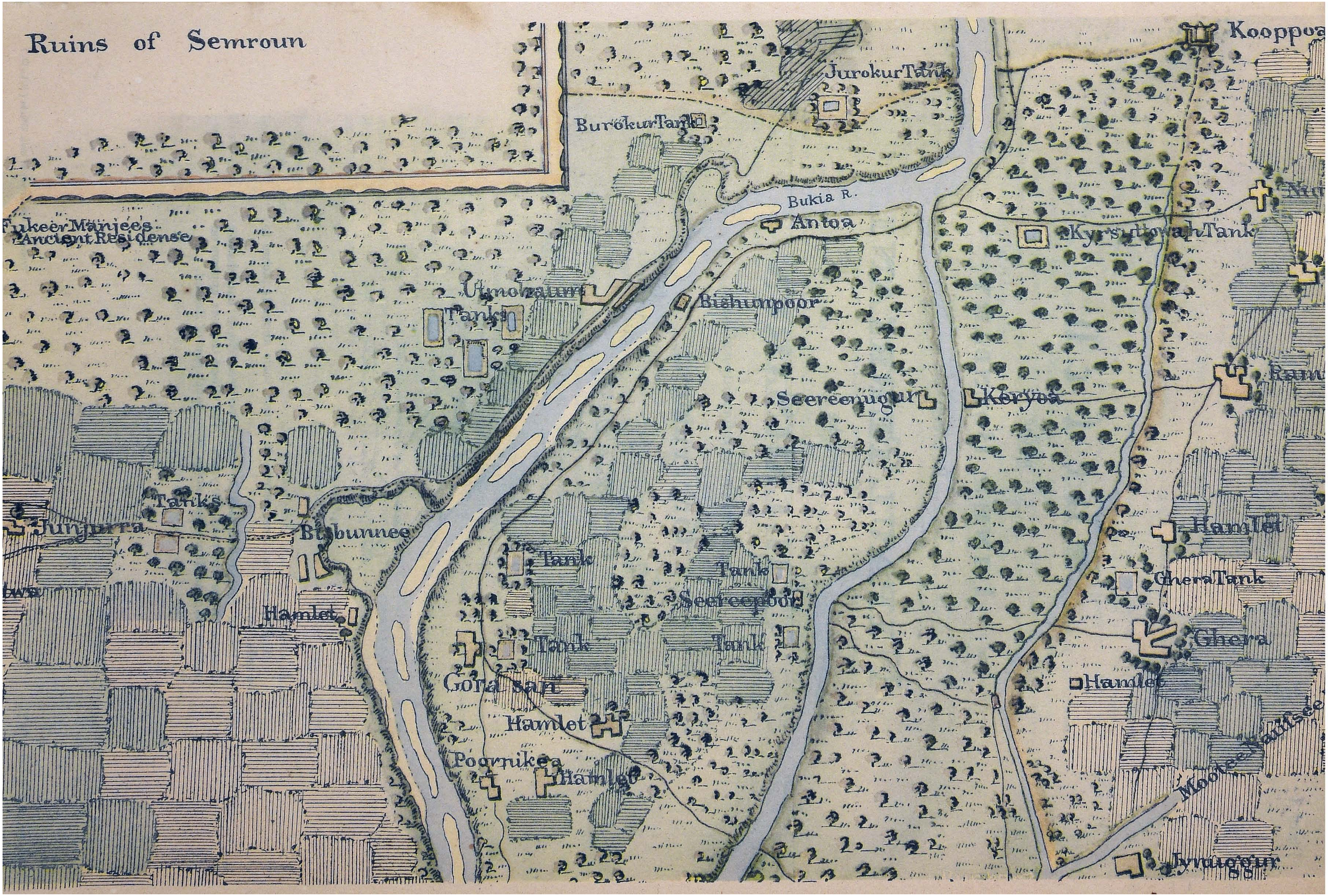
He was called off in February 1818 to start survey on the northern boundary of Oudh, but returned to Jaunpur in June with little accomplished and,

having made a survey of the cantonments and some part of the town, I availed myself of the first fair weather of going to Azimgarh, where I remained during the rainy season, which was at an end by the 31st October[10].

He then moved back to the Oudh–Nepāl frontier :

I had been instructed to execute this survey in the begining of 1818, but the absence of the Commissioners...detained me till April in the neighbourhood of Buhraitch[11]. The season of the year was obviously too far advanced to leave a hope of its being terminated before the end of June, and in the month of April the country is deserted and uninhabitable from the prevalence of ...fever. ...

[1] MRIO. Misc. 13–O–18. [2] from Resdt., Kātmandu, 11–3–20 ; B Pol C. 3–4–20. [3] *Ben P & P.* XVI (26); MRIO. 49 (6) ; 51 (4, 5). [4] Bogle (cxxvii). [5] MRIO. 90 (1). [6] BJC. 23–9–17 ; BMC. 7–10–17 (126) ; maps, MRIO. 24 (18–21). [7] BJC. 27–1–18; DDn. 133 (437). [8] Fdbks. MRIO. M 321, 391 ; Maps ib. 17 (14, 17, 23) ; 24 (18). [9] DDn. 153 (169), Dec. 1819. [10] Fdbk. DDn. 163 (99). [11] 63 E/10.


Ruins of Semroun
Kooppoa
Jurokur Tank
Burokur Tank
Bukia R.
Antoa
Fukeer Manjees Ancient Residense
Bishunpoor
Tanks
Seereenugur
Keryoa
Tanks
Junjurra
Bishunnee
Hamlet
Tank
Tank
Seereepoor
Tank
Tank
Gora san
Hamlet
Poornikea
Hamlet
Hamlet
Ghera Tank
Ghera
Hamlet
Jynuggur

Sketch

of the

LINE of BOUNDARY

Between

NIPAUL TERRIANI

and the

ZILLAH SARUN

Prepared for the information of the

Government

by

J. Pickersgill Lieut. Dep. Assist. Qr. Mast. Genl.

1817

J. Pickersgill

Lieut. Surveyor on

the Northern Frontier.

Slightly reduced from planetable survey, scale about 1¼ inches to a mile [19].

Brown riband indicates boundary between Nepāl and district Champāran for the next 130 years. The village Gorasan appears on modern maps as Ghorashan, about 20 m. south-east of Raxaul.

Reg. No. 4838 HD '50—800'51.

Printed at the Survey of India Offices (H. L. O.)

It was proposed, however, to resume the survey during the ensuing cold season, and I was accordingly prepared to commence it in the end of December; the absence of the Vizier's Commissioner, however, protracted the commencement...till the beginning of February [1819]. The disputes that occurred...as to...the interpretation given to the treaty... protracted...the survey till the end of March, when it was found necessary to submit the whole proceedings for the final decision of Government.

According to the interpretation given by the British authorities, the base of the nearest range of mountains was to be considered as the boundary, ... and in those places where... rivers issued from the mountains, ... pillars were to be erected. ... Plans at large will hereafter be transmitted of those spots where an artificial boundary may be deemed necessary[1].

The Resident in Kātmandu pointed out the Gurkha view;

It is not to be supposed that the foot of the continuous range of hills is so distinctly marked as not to leave spots of ground which may be reasonably contested; those contested grounds may...be valuable to both parties. The recesses between the projecting ridges will in some instances be found to terminate on the passes in the mountains, and rigid construction on the terms of cession may possibly place the very defences of the passes into the hands of the Nawaub Vizier.

There can be no doubt that an apprehension of this nature has had great weight with the administration, and induced much of the hesitation which has attended the recognition of our demand and, if the principle be carried to its greatest length, it must...cause great irritation in this Durbar[2].

After spending the rains of 1819 at Lucknow and surveying the Rāmganga above Farrukhābād, Grant returned to complete the demarcation;

This survey was terminated in February 1820; my stay in the terai did not exceed four months. ... The primary object of the survey was to determine the line of demarcation between the states of Oude and Nepaul, and I was directed to superintend the construction of boundary pillars where no natural boundary existed[3].

The following extracts are taken from his fieldbooks[4];

On the 2nd December 1818, I received my final instructions from the Resident at Lucknow respecting the demarcation of the northern frontier of Oude; as also a copy of the first article of a treaty concluded between the British and Oude Governments, by which the former cede to the latter the province of Khyreegurh, etc.[5]. ...

6th Jan. 1819. I was desirous of observing the azimuth of some peaks in the 1st range of hills; but the atmosphere was so extremely hazy, and the smoke arising from the burning of the grass jungle was so dense, that nothing could be seen. Add to this I was encamped in a wide and barren waste where there was scarcely a tree to be seen; a cold wind blew from the west. The thermometer fell to 30° in the tent, and the servants and cattle without any cover were almost frozen. I never indeed suffered a greater degree of cold in India. ...

1st January 1820. Halted at Singhai for workmen who were expected from Lucknow to construct pillars of masonry. ...

2nd. Halted. The Oude Commissioner and the workmen joined this day. ...

9th. Marched to Burelia Ghaut on the left bank of the Gograh. From the 10th to 16th January I halted for the Nepalese Commissioner, but finding there was no prospect of his joining me for some days, I caused a pillar of masonry to be constructed on the left bank of the Gograh in Lat. 29° 4′ 00″ and Long. 80° 5′ 00″. ...

22nd. Nepalese Commissioner joined this day. ...

24th. Series of 24 lunar observations for longitude. ...

1st February. Surveyed the Murela...laid down in the survey of February 1819. Here therefore terminates the survey of the N. frontier. It only remained for me to proceed to the Mongsoth N. and to see that the turrai in that quarter was evacuated, and to superintend the construction of pillars in the right and left banks of the Rapti. ...

24th. Marched to Goruckpoor. I propose remaining some days to finish my reports.

On 15th March he moved out again from Gorakhpur to complete the western boundary of the district;

30th. Halt for the Oude Commissioner, and employed in making enquiries about the boundary. ...

31st. Received from the Resident 9 unfinished maps of the Tirhut and Morung Frontier to be completed. They were begun by Lieut. Boileau, who died before completion [20].

[1] DDn. 153 (169–80), Dec. 1810; also IO Maps. MS. 30. [2] DDn. 153 (155), 24–8–19. [3] Journal, DDn. 163 (371), 2–12–21. [4] DDn. 163; M 390. [5] First ceded to Nepāl by the British; MRIO. M 391.

He closed work in the middle of June when the rains set in, and sent his maps down to the Surveyor General the following month[1]. Final maps followed in March 1821 by the hand of Arthur Fitzpatrick, who had been attached as assistant for the past year [12 n.9].

1st. ... Portion of the Goruckpoor frontier...where it touches the dominions of the King of Oude. ... Scale 1 inch to the English mile. ...

2ndly. ... Furruckabad frontier, ... comprehending that portion of the peninsula within the Ganges and Ramgunga rivers which appertains to the King of Oude.

3rdly. ... Western frontier of Azimgarh and Jounpoor, ... 3 miles to one inch.

4thly. ... Northern frontier of Oude, ... from the Urrah Nuddee to the Kali, or Gogra, ... 2½ miles to one inch[2]. ... Boundary pillars...established in the gorges of the mountains...laid down from survey combined with astronomical observation, but in a country intersected with thick and almost impervious forests very great accuracy as to the relative longitude cannot be expected.

The writing in all these maps has been performed by Mr. Fitzpatrick, whose zeal and deligence is highly commendible. The mountainous parts I myself have delineated. ...

For several important reasons I made no attempt to examine the southern chain of mountains, or even to pursue enquiry among those who were best qualified to afford information. ...

5thly. ... Various surveys...from Furrukabad to the Gunduk, comprehending also the mountainous regions to the north of Oude, and of the district of Goruckpoor, ... 5 English miles to one inch[3].

A few months later Grant was placed in charge of the revenue survey of Gorakhpur district [151].

SAHĀRANPUR & DEHRA, 1815–9

For some years the Commissioners of the Ceded and Conquered Provinces had been pressing for a survey to assist assessment and collection of revenues, and at the end of 1815 Alexander Gerard, whose survey of Sahāranpur had been interrupted by the Nepāl war, was again put at their disposal [II, 180 ; III, 157]. As the "minute topographical survey" which the Commissioners asked for would take too much time, Gerard confined himself to a "correct trigonometrical survey", which was no more than a series of traverse circuits, by perambulator or pacing, with bearings by theodolite compass, corrected for needle variation[4]. He completed the north division of Sahāranpur which at that time included Dehra Dūn, and also Morādābād district, by May 1818[5].

He gives a good description of the Dūn [II, 82–4 ; pl. 10 ; III, pl. 3] ;

The cultivation is not marked from actual measurement, but from what I supposed to be nearly right, in order to give some idea of the quantity of waste land in the Doon[6].

Roads. The only carriage roads thro' the Doon are from...Timli Pass, via Dehra, to Kansrow Pass on the foot of Bheem gora. From there to Dehra, and from Joolapoor to Lukughat. The above roads are bad, and drag ropes are frequently necessary. Throughout the rest of the Doon there are nothing but footpaths, often impracticable for camels and sometimes for horses. ...

Rivers. The canal which supplies Dehra and some of the surrounding villages with water is cut from the Rispana, and runs in the hot weather. ...

Hills. The outer range of the Doon[7] is composed of sandstone, with some pieces of quartz intermixed. There is not a single village nor the least cultivation upon them, and the whole is entirely covered with low sal, kanta, and small bamboos ; there are likewise some firs, but not in any quantity. I ascertained the height of a few of the peaks, and found them from 2,000 to 2,500 feet above the sea.

The other range which divides the Doon from Garhwal is composed of a bluish kind of clay slate, with a few pieces of limestone and quartz here and there. The northern face is in general covered with oak, boorahs...and firs, and the southern exposures with thick kanta and kawada bushes. They are very rugged and abrupt, and consquently there is very little

[1] DDn. 147 (160), 5-7-20. Maps, MRIO. Misc. 8-0-30. [2] ib. 17 (22) *IO Cat.* (217). [3] DDn. 147 (180), 12-3-21 ; Maps, MRIO. 16 (32-7, 40-1) ; 17 (14-9, 22). [4] Fdbk. DDn. 138. [5] Maps, 2 m. to 1 inch, MRIO. 25 (3-4, 62-4) 26 (16) 185 (10). [6] DDn. 212 (15), 25-11-18. [7] Siwālik Range.

cultivation upon them. The fields seldom exceed 10 or 15 feet in breadth, and run along the faces of the hill like steps.

I have noted in the map the heights of a few of the principal peaks, which are all I could accurately ascertain trigonometrically. I might have determined the altitude of the others I passed over, had not my two barometers been broke a few days after my arrival at Dehra [204].

Villages. Throughout the Doon the villages are...very poor, consisting of seldom more than 5 or 6 mud huts. Those on the hills...are likewise small, but the houses are better constructed, being built of stone two stories high, and covered with slate or flat-roofed.

Jungle. The different kinds of jungle are put down in the map. Large sal timber is scarce, being only found in Rajbur, West of the Jumna, and near Lukurghat. The grass and surkhunda jungle grows to a great height, and affords cover to elephants, tigers, leopards, bears, hogs, and deer, with which the valley abounds. ...

Mines. There are several mines in the district of Jounsar[1], which borders upon the Doon, and belongs to the British Government. There is a copper mine at Kalsee, not worked at present owing to the hardness of the rock. The Gorkhas tried it but found the expence of labour too great. There is an iron mine at Busan on the banks of the Jumna, and both iron and lead mines at...Lohakundee, a high mountain...about 12 miles north west of Bhyrat; the latter are worked. Gold is found in small quantities in the sands of the Ganges. ...

Climate. From the vicinity of the hills the weather is in general [mild ?]. In the cold season the thermometer ranges from 60° to 70° in a tent at noon, and at night was about 50°. In May and June I...found the heat oppressive, the thermometer being 118° in tents.

The outer range of hills is seldom covered with snow, and what falls hardly ever lies the whole day unless it be cloudy. The other range is covered with snow for about 4 months in the year, and several of the high peaks much longer. In the beginning of November snow fell upon Bhudrajh, the thermometer being 31° about an hour after sunrise, and I understand in January the snow is from 5 to 6 feet deep upon Bhyrath and Bhudrajh [30–4; pl.5][2].

In November 1818, Gerard reported that he had been

directed by the Board of Commissioners to survey the whole of the Ceded and Conquered Provinces, to make out the map upon such a scale as to include every single village, hamlet, and to define the boundaries of the purganas as exactly as possible.

Last season I was employed partly in the Dehra Dun, partly in the Moradabad District. In the Doon I surveyed 224 square miles, in Moradabad about 1536, making a total of 1760. ...

If you wish the original map of Saharanpoor...I can despatch it immediately, but I am in hopes you will allow me to furnish you with a fair copy, for it is just as it was protracted, in 4 pieces of paper, sadly disfigured and blotted; it likewise contains part of the southern division of Saharanpoor, in the survey of which I have made considerable progress[3].

He continued survey of the southern division of Sahāranpur until 1st February 1819, when "the office of Surveyor to the Board of Commissioners" was abolished. A portion of his half-inch map of the Dūn, beautifully drawn by his assistant Blandford, is reproduced as plate 3.

DELHI CANALS

Proposals for the restoration of the old Jumna canals, which had led to the surveys by Tod and Macartney during 1810 and 1811[4], had been put aside owing to the distractions of the Nepāl war.

A survey and design for the work of re-opening the Delhi canal was completed...by Lt. Macartney, of the cavalry, in the year 1810; this was further followed up, if not preceded, by several reports by other officers on the subject (Lt. White of the Infantry [II, 67] and Lt. Fordyce of the Engineers[5], amongst the number), and elicited such a variety of opinion from Colonels Kyd, Garstin, and Colebrooke, either as Surveyor Generals, or Chief Engineers [II, 67–9], that the matter seems to have fallen into abeyance[6].

The subject was again brought to notice by Rodney Blane [II, 383], who wrote from Delhi in 1816;

Being at this time quite unoccupied, ... it has occurred to me that if the existing papers and surveys relating to the Delhi Canal could...be entrusted to my charge, considerable

[1] Chakrāta. [2] DDn. 133 (150–61). [3] DDn. 212 (3), 25–11–18. [4] Tod surveyed the E. Jumna canal, on left bank of Jumna; Macartney surveyed the W. Jumna or Delhi canal [II, 68–9]. [5] Arthur Dingwall Fordyce, Ben. Engrs. Ens. 1801; Capt. 1810; d. at sea on passage home, 1812. [6] *JASB.* II, 1833 (112).

preparation might be made towards carrying into execution the intended repairs. ... With the assistance of these materials, and from such an examination of the course of the canal between Delhi and Kurnaul as may be made when I am returning to Loodhianah, an estimate of the expence might be framed[1].

After long search, Macartney's plans and reports were retrieved and entrusted to Blane, who made a good start in the reconstruction of the canal. On his death the work was carried on by Colvin and Tickell, Colvin holding the appointment of Superintendent of Canals from 1827 till 1839[2].

In 1809 Hodgson had called attention to the possibility of restoring the old Ferozeshah canal that had once watered Hariāna [II, 65, 69], and Colvin had noticed the same derelict canal when surveying on the Bhatti frontier in 1818[3]. In March 1820, Colvin was appointed "to survey the course of the ancient canal, Chittang Naddie", and he completed this and the survey of the Ferozeshah canal between November 1820 and January 1821. He ran levels—measured a base—observed triangles—and produced a useful map showing his marches, with a separate one for the Resident at Delhi to show administrative boundaries[4].

The survey and restoration of the *doāb* canal, east of the Jumna, was carried out by Henry De Budé and Robert Smith between 1822 and 1830[5].

ALLAHĀBĀD TO AGRA, 1827–8

In 1821 Hodgson, now Surveyor General, obtained sanction for Alexander Boileau to resurvey the country between Allahābād and Cawnpore. The accuracy of the old maps had long been suspect owing, as Colebrooke suggested, to carelessness on the part of Reuben Burrow in letting his chronometers run down [I, 163 ; II, 190–1]. Hodgson wrote that, being

now employed in the construction of an Atlas of India on the scale of 4 British miles to an inch [284–5], ... I am anxious that the map should be as full and accurate as possible. ... The lower part of the doab from Cawnpoor to Allahabad might be resurveyed with advantage, as the map ...presents many blank spaces, and it is a compilation of which I suspect the accuracy. ... A corrected map on the scale of two miles to an inch would be a useful document to the Judicial as well as the Military office, and...an important component part of the atlas[6].

To Boileau he writes ;

The survey...will be of a cursory nature only, ... completed in one season or perhaps in a less period[7]. ... It seems...not impossible that the compiler of the map[8]...has...protracted the survey routes probably too long, for those lines were surveyed by different persons. ... Sufficient allowances may not have been made for the winding of the roads and...it is difficult for me to insert this tract of country into the general maps. ... To clear up any doubt...you are directed to...remeasure some of the principal lines, and to trace some new ones. ...

When you have completed the line to Cawnpore, you will cross the doab thence to Calpee, and thence make diagonal sketches...from the Jumna to the Ganges and back alternately, ... laying down many villages which are not in the old map, and...ascertaining the accuracy of your main line. ... The more villages you can lay down the better, and your enquiries...may be usefully directed...to the distance of 8 or 10 miles[9] [3].

Starting from Allahābād in October, Boileau ran his traverse first to Cawnpore, and then made a series of zigzags between the Jumna and the Ganges, passing through Cawnpore 1st December, Kālpi 28th, Fatehpur 23rd January 1828, and back to Allahābād on 11th March. He then worked up through Ghāzipur to close at Cawnpore on 30th April[10]. The following notes are taken from his fieldbook[11] ;

[1] from Blane 12–3–16 ; BMC. 13–4–16 (31). [2] History of these canals by Colvin, *JASB.* I (105) ; II, March 1833 (105–27). [3] Fdbk., 15–8–*to* 28–9–18, MRIO. M 548 ; Oct. 1818, ib. 12 (26) ; 81 (12, 13) ; 16) (25–7). [4] DDn. 180, M 465 ; MRIO. M 397 ; general map in 3 sheets, ib. 180 (25–7) ; *IO Cat.* (233) gives Colvin's map of Jumna canals, Delhi Territory [155 n.5]. [5] *JASB.* II, 1833 (116) ; map by De Budé, MRIO. 168 (14). [6] DDn. 204 (325), 5–7–27. [7] ib. (246), 26–7–27. [8] C. G. Nicholls [II, 433], MRIO. 16 (9). [9] DDn. 220 (266) 7–9–27. [10] Maps, MRIO. 25 (46), (33), 31 (33). [11] ib. M 348.

The primary object...being to ascertain the longitude of Caunpoor by a series of accurate measurements connecting a given point at Allahabad with the garrison flagstaff at that station, as well as...to fill in the...unsurveyed portions of the lower doab, ... [I] measured a short base and laid out a triangle. ...

20th November 1827.—[Used two perambulators the whole time]—the two hands of Capt. Gerard's perambulator do not always exhibit the same proportional parts of a mile, owing to the looseness of the shorter index. ...

Many of the stations may appear to be unnecessarily short ; and indeed they are, but the camel-flag-bearers are quite new in their office, and have not yet learnt how to judge for themselves in taking up proper points when sent on ahead [II, 202]. ...

I have been employing my spare time...in practising with the sextant & chronometer, to take the altitudes & times at the same instant, & find that I can already ascertain the error of the watch to within less than a second. ... Hoping to improve by practice. ...

10th December. I have at length brought my work to a close at the Magazine Ghat at Caunpoor, & am very much surprised to find that I cannot make my observations on this spot agree *at all* with those of Mr. Burrow, who must of course be correct, as he was one of the first astronomers of his day[1]. ... The perambulator & my sextant agree pretty well together, ... but I am mortified at finding my altitudes differ so much from those of such an excellent observer as Mr. Burrow.

He writes to the Surveyor General ;

16th January 1828. On arriving at Surajpoor on the Ganges...I was enabled to bring my measurement to a close, for the first time during a run of upwards of 200 miles, on a point from which I had taken a circuit of upwards of 80 miles via Caunpoor, and had the satisfaction to find that my rough protractions of the route closed within ½ a mile of the proper point.

8th February. The old map is very incorrect in some matters. ... There are some of the villages on the wrong side of the Jumna, and some of the small rivers running in places where I could discover no trace of them. The entire zigzag to Allahabad will probably be completed by the middle of end of March.

5th March. The different lines agree very well with each other at the points of meeting. ... The whole of the work is protracted from the very commencement to the close of this morning's work, and the whole of the traverses are brought up. ... The more the old map is examined the more errors are discovered in it, and the smaller rivers are particularly faulty. The different routes, too, not having been laid down by the same person, differ considerably ...from those which have all been taken with the same theodolite & the same perambulators.

27th March. I am keeping as much as possible among the blank spaces in the map, that these unknown parts may be filled in correctly. The three measurements from Caunpoor to Allahabad ought to give the relative longitudes of these places very near the truth, being assisted by your latitudes (and those of Mr. Burrow), if I can identify your bungalow, but there was no plan of cantonments in Caunpoor...as the Superintending Engineer had taken it on tour with him.

Caunpoor, 2nd May. Having arrived at Caunpoor so much earlier than I expected, there are now nearly two months of this season remaining, in which I think I can manage *both* the lines you wished to have measured before the rains, that is, from Caunpoor to Fattehgurh, & from thence to Agra. I am now waiting for the repair of 2 of my perambulators, one of which is much out of order & I expect to reach Futtehgurh about the end of this month.

7th May. As I am actually on my way to Agra, and the weather is still very fine, I think that I can complete both the desired lines before the rains, and will do my best to ascertain the relative longitudes of Futtehgurh, the Taj, and Caunpoor [190].

Hodgson replies ;

You have done good work in getting through the lower doab so well and quickly, and I will be glad to hear [that you have reached] shelter at Agra, for the weather must be very hot. However, I hope your health will not suffer from being in camp in hot winds ; mine never did, and I think I was better in the field, changing ground every day, than in a house, and the time certainly passed more lightly[2].

Boileau compiled his survey into a "large map of the lower dooab, on a scale of two geographical miles to an inch"[3], which he submitted from Agra in September, and Hodgson reported the satisfactory conclusion of the survey ;

[1] Boileau's latitude for Cawnpore 26° 29′ 7″·7 ; true position 26° 28′ N. ; 80° 21′ E. [2] DDn. 220 (331), 14–5–28. [3] Memoir describing map, 11–1–29, MRIO. 25 (40) ; other maps, ib. 25 (45) 29 (45–7), 31 (42) ; for details see DDn. 415 (16), 18–10–45.

Lieutenant Boileau, whom I guided in all the details of his duty by correspondence, has executed the work...in a manner very much to his credit, and has, under my special instructions, carried lines from my observatory at Futtehgurh [189] to the Tajh at Agra. ...

The old surveys of the lower dooab, which required revision as I supposed they would, have been corrected, and the country between Cawnpore and Allahabad has been traversed and intersected in many directions, and the difference of longitude between the two places is now satisfactorily settled. The old difference has, as I supposed it would, proved very considerably in error. The other lines above Cawnpore were found to be correct[1].

This was the last deliberate peace-time survey to be based wholly on traverse and astronomical fixings.

AGRA, 1829–30

The capture of Bharatpur in January 1826[2] opened up new country, and after Boileau's arrival at Agra Hodgson ordered him to measure a base-line between Agra and Delhi, and carry triangulation into Bharatpur, from which detail survey could be extended by theodolite traverse ;

What your next season's work will be I cannot exactly say at present, but either in Bhurtpoor or Rohilcund, probably. If the former, we must proceed from a measured base. When at Agra you may examine the ground. I think 2½ or 3 miles...fit for a base may be found near where General Nicholl's[3] division was encamped before the siege. If so, the Taj, Secundra, and other buildings, are points, and sides must be found to connect them to Futtehpoor Seckri, whence the citadel of Bhurtpoor and the Taj are visible, and the principal forts, Kumar Deig, etc., will be fine points in Bhurtpoor country, and we can sketch easily to Alwar, etc. [203].

Perhaps you may find ground for a base ½ way between Agra to Futtepoor Secri where both are visible ; there is a chain and coffers, etc., in the Agra magazine [250][4].

Boileau was directed first to make connection with the Jumma Musjid in Delhi, and to traverse

from the Taj at Agra...to the fort of Bhurtpoor through Chaksana, and to return...by Fattehpoor Sikri, that the difference of longitude might be ascertained by a double measurement, ... examining what ground...would be best adapted for the measurement of a base[5].

He did this

without any accident or interruption, though I have just received a public notice...through the Political Agent at Bhurtpoor, forbidding me to carry on any surveying operations in the Bhurtpoor State. Though Major Locket [II, 417] could not publickly lend me his assistance in running the perambulators through this independent territory, yet he very kindly furnished me with such aid...previous to the arrival of this order, and the people of the country, far from throwing any obstacles in the way of the work, were perfectly civil and obliging[6].

Whilst waiting for permission to cross the Bharatpur frontier, Boileau,

being quite tired of remaining still at Agra, ... took an opportunity of running down to Jeypoor early in April 1829, taking with me a sextant and chronometer for the purpose of ascertaining the latitude and longitude of that place[7]. ... Being positively forbidden...I dared not carry on any route survey beyond our frontier, but when the prohibition is removed, I hope some opportunity will occur of verifying the above. ... I will prepare to undertake the measurement of a base between Agra and Fattehpoor Seekree[8].

At last, in August 1829, the ban was removed[9] to his great delight ;

for really I have been so many months eating the bread of idleness that I began to be quite ashamed of myself. ... Further examination will, I hope, enable me to find sufficient ground for a base of five miles, and there will no doubt be a less objectionable method of connecting the Taj at Agra with the proposed chain of triangles than by the mode formerly suggested[10].

He spent November and December

reconnoitring the country south of Agra, within the dominions of the Company, which was flat and difficult for triangulation. ... I have found three places southward of Agra which would form nearly an equilateral triangle with Akbar's Tomb at Sikandra and the gateway of Fattehpoor Seekree. ... Having completed a very minute examination of all the country immediately south of Agra, ... the following month will be chiefly employed near Muttra[11].

[1] DDn. 231 (198), 22–12–28. [2] Plans survd. during siege, MRIO. 83 (9–11). [3] Gen Sir Jasper Nicholls (1778–1849) ; C-in-C., 1839–43 ; *DNB*. [4] One of the GTS. chains [246] ; DDn. 220 (331), 14–5–28. [5] DDn. 227 ; Fdbk. M 314, 1–11–28. [6] ib., 16–11–28. [7] Fixed by Hodgson ten years earlier [34]. [8] ib. 9–6–29. [9] DDn. 231 (280), 11–8–29. [10] DDn. 227, 30–8–29. [11] DDn. 229, M 530 ; 1–1–30.

He reported later that

> nearly the whole of the central and northern parts of the Agra and Muttra frontier have been very minutely surveyed, and all elevated points have been carefully noted which may assist in carrying on the intended triangulation. No difficulty will occur in finding convenient stations within the Bhurtpoor territory, and many difficulties have been already done away with, ... but much yet remains to be done to the southward and westward of Agra[1].

He completed his survey of Bharatpur during the next two years.

ROADS

During the Marātha war of 1817–8, Quartermaster General's officers of all three presidencies were employed on military surveys, and from 1st January 1817 a special cadre was authorized for the Bengal army, as had been formed in Madras in 1810 [II, 321–2 ; III, 334–7]. To avoid infringing on the responsibilities of the Surveyor General, duties were restricted to the survey of roads and communications ;

> On the close of operations...the officers of the Quarter Master General's Department being disposeable, His Excellency the Commander in Chief...has directed that they should be immediately employed in furthering the object of...the Superintendent in the Western Provinces. ...
>
> You are...to commence a survey of the roads, etc., in the District of—. The survey...is to be confined to the roads with the objects immediately on them, or adjacent thereto, and is to consult both civil and military convenience. ...
>
> The more immediate object being to enable the magistrates to determine on arrangements for the general convenience and security of travellers, the officers employed will carefully examine the localities of the several police chokies, ... and recommend such positions as in their judgements may seem to be better...than those at present fixed on.

The surveyors were to make daily observations for latitude, weather permitting, and to keep close touch with the Superintendent of Police ; they were to be employed at least six days in seven, unless interrupted by indisposition or the inclemency of the weather, and during the periodical rains their attention is to be devoted to the compilations and topography of their surveys, of which three copies are to be prepared, both of the maps and field books, in order that the Quarter Master General of the Army, the Superintendent of Police, and the Magistrate of the District may each have one[2].

From October 1818, all military roads were placed under the control of the Quartermaster General, including that between Calcutta and Benares [I, 368][3]. In 1820 the establishment included Ezekiel Barton [II, 380–1] as D.Q.M.G. with headquarters at Cawnpore ; James Franklin as A.Q.M.G., and a number of D.A.Q.M.G.'s [335–7]. Copies of surveys were sent as a matter of routine to the Surveyor General[4], and included roads in Rohilkhand by William Garden—routes in Allahābād district, and thence to Nāgpur via Rewah and Jubbulpur, by Becher—roads to the north of Delhi by Paton—and through Mirzāpur and Rewah by Drummond.

Officers of the Rāmgarh Battalion were still interested in surveying roads of Chota Nāgpur, and in 1817 Ferguson surveyed the road from Gaya to Patna[5] under the direction of Roughsedge, president of the road committee. In 1822 James Aire, of "the Hill Bildars", was one of the officers surveying new roads of Singbhūm[6]. Surveys through Central India, Mālwa, and Rājputāna, will be noted in a later chapter [83–90].

During the Burmese war, when most of these officers were on active service, "Superintendence and Executive charge of all public roads" was transferred to "the Department of Public Works"[7].

During 1819 Jackson [II, 409 ; III, 12] surveyed the line for a road between Midnapore and Nāgpur through Keonjar and Sambalpur, receiving instructions that

[1] DDn. 229, M 530 ; 1–5–30 ; see also M 315, 317, 319, 523 which contain ½-inch maps of Agra–Muttra frontier, beautifully clear and neat ; other maps are MRIO. 15 (6) ; 29 (3–14). [2] DDn. 282 (290), 30–3–18. [3] BGO., GG., 10–10–18. [4] MRIO. M 379 ; 31 (30) ; 32 (1–57). [5] presumably that surveyed by Peckett in 1812 [II, 436]. [6] MRIO. 46 (35). [7] BGO. 30–9–25.

the precise direction...must be faithfully laid down, giving full and distinct reasons for all windings, and the most particular account of the nature of the soil and features of the country, whether open or through jungle, plains, ascents and descents, and, where low and requiring to be raised, the probable quantity of labour and means of accomplishing it; what trenches or drains for water-courses, or bridges, will be necessary.

The outline of towns and villages...must be given, with the streets passing through them, and defences where they have any; also of all forts, buildings of importance, bridges, tanks, etc., not to mention wells wherever met with, or...wanted for the convenience of troops or other travellers. ...

A particular description will be expected of all rivers, nullahs, ghauts, passes, fords, and ferries, ... and the names and residences of the zemindars to whom the villages and lands belong, or by whom rented. ... The climate, ... the populations and castes; number and description of their cattle and carriages, produce of the crops, and state of manufactures[1].

Without, perhaps, collecting quite all the information here called for, Jackson produced a useful map, and the road was constructed on his

rough estimate of probable expence of constructing a road from Midnapoor to Nagpoor, 30 feet wide, and clearing away 25 yards of jungle on either side—Rs. 3,38,448 for the part thro' the Company's dominions—Rs. 2,75,136...thro' Nagpoor—Rs. 6,13,585 total[2].

An advertisement in the *Government Gazette* of 22nd June 1820 reads that

Dak runners have recently been laid on the direct route betwixt Calcutta and Nagpore, a route lately explored and surveyed by Captain Jackson. This line of communication with the capital of Berar runs nearly in an easterly direction through Raipur, and shortens the dak to Bombay [266 n.1].

At the end of 1829 Gilmore and Ommanney, both of the Engineers, were deputed to survey the line for a road from Burdwān to Bihār, which was afterwards to be constructed as part of the Grand Trunk Road.

There was a direct road from Burdwan to Behar formerly used, ... and though not now frequented...it appears probable that by pursuing its course the surveyors will meet fewer obstructions than they would be likely to encounter in any other direction. It is also probable that coal, lime, and other materials, will be found...for the construction of any bridges that might be necessary[3].

The Surveyor General gave Gilmore detailed instructions;

You will commence...at Burdwan, and...survey by perambulator measurements and magnetic bearings, intersecting all remarkable objects to right and left, and especially...such features of the country as may be useful in defining the proposed line. You will also...report on the natural productions...such as coal, limestone, etc. ...

It is supposed that...you may survey daily from 6 to 8 miles according to the difficulties of the country. This distance you will protract, filling in all the details during the heat of the day when your work in the field is suspended, as it essential to the accuracy of such a work that the map should keep pace with the field book.

The scale of these field protractions will be 2 miles to an inch; these will be afterwards combined and reduced to a scale of 4 when the whole is finished. It will be necessary also to take daily azimuths for the ascertainment of the error of the needle. ... You will forward to this office on the 1st of each month a report of your progress. ...

In the accompanying sketch...you will find laid down several triangles belonging to the series of the Great Trigonometrical Survey[4]. ... You should check your operations by connecting them with those fixed points. ... The simplest method of doing this will be to observe the angles subtended by any three of those stations that may be visible, by observing their azimuths with the theodolite which has been furnished you[5].

Gilmore reported the completion of the survey[6] in a letter from Patna dated 22nd March, and then returned to Calcutta and discharged his staff. His road ran through Rāniganj, Rupnarainpur, Palāmau, Karakdiha, to Bihār, about 36 miles south-east of Patna[7].

[1] DDn. 133 (529), 1-12-18. [2] Fdbk. MRIO. M. 221. [3] from Mil. Dept. to SG., DDn. 263 (91), 11-12-29. [4] Olliver's longitudinal series [261-4]. [5] what we now call a theodolite resection [197]; SG. to Gilmore, DDn. 267 (1), 6-1-30. [6] Fdbk. M 246; maps MRIO. 46 (1-3). [7] Report, DDn. 265 (31-9), 23-7-30.

CHAPTER III

THE MOUNTAIN PROVINCES

Garhwāl & Sirmūr, 1815–8 — 1818–9 — 1819–22 — Upper Sutlej Valley, 1817–23 — Kumaun, 1816–21.

THOUGH the glorious views of the snow peaks had long fascinated surveyors toiling in the plains, it was not until the Gurkhas had been dispossessed of their Himālayan conquests, and had accepted the Kāli River as their western boundary, that any regular survey of the mountains was possible [II, 84, 89].

Robert Colebrooke, Crawford, Webb, and Hodgson, had set their hearts on penetrating into the mountains and discovering the secrets that lay beyond the lower foothills. Sickness and death had robbed Colebrooke of any greater joy than taking distant observations and calculating the heights of a few recognizable peaks [II, 86–7]—Crawford had the thrill of actually working in the mountains of Nepāl [II, 70–2 ; pl. 8]—Webb had penetrated far up the two main branches of the Ganges, and was now given the survey of Kumaun [II, 70–7 ; pl. 9]—and it fell to Hodgson who had already climbed the lower spurs above the Dūn [II, 82–4 ; pl. 10] to lead the regular survey which Lord Moira sanctioned at the end of 1815 ;

A favorable opportunity now offers for making a correct survey of the lately liberated provinces of Gurawal, Sirmoor, and Hindoor[1], as well as of the countries to the north... reaching to the Himalehah, a tract which comprizes the sources of the Ganges, Jumna, Tonse (hitherto unknown though larger than the Jumna[2]), and Sutledge rivers, and which is bounded by some of the noblest mountains of the world [pl. 5].

The whole of those provinces are now...under British protection or influence. ... A survey could therefore be carried on...at leisure, ... as immediately beneficial to the public interests as it would add to geographical science. ...

An ascertainment of the heads and courses of the four great rivers, and of the heights and distances of the snowy peaks, are now completely within reach of British research and enterprise. These are objects becoming the attention of an enlightened Government.

The prospect of a speedy termination to the present war with Nepaul, and the little probability there is that Captain Hodgson would ever be allowed to enter that country in time of peace for...making a leisurely and extensive survey, induced the Commander-in-Chief[3] to think he might be more advantageously employed in making the survey above described, and he has accordingly directed that officer to proceed towards the upper part of the dooab, subject however to be recalled in the event of the army on the frontier of Sarun and Tirhoot[4] taking the field [II, 43 ; III, 1, 2]. ...

Captain Hodgson is well known as a practised trigonometrical surveyor of no common stamp. ... He purposes to measure a long base on the plains of the upper part of the dooab or of Rohilcund, and then proceed with a series of grand triangles, in which the highest and most remarkable mountains would form stations, whence every peak and range visible may be laid down with the greatest accuracy. At favourable seasons, when the snow is sufficiently melted, the sources of the great rivers may be visited and determined with precision[5].

Hodgson was appointed to this charge from 17th October 1815, keeping as assistants Ezekiel Barton and two young engineer officers, Edward Garstin and Paton, who had been with him on the Nepāl frontier [II, 41 ; pl. 21 n.].

He reached Sahāranpur on 30th December, and after searching without success for a suitable site for a base-line, and losing several weeks from a return of the

[1] or Nālagarh, one of the Simla States, west of Sirmūr, 53 A/12, 16. [2] volume actually greater than that of Jumna at confluence ; *Imp Gaz.* XXIII, 418–9. [3] Lord Moira held both offices, GG. & C-in-C. [4] 72 B & F. [5] From AG., DDn. 141 (181), 27–9–15.

fever which he had picked up in the *tarai* [II, 42], he decided to postpone ground measurement, and to start his survey from astronomical observations.

The fever & ague by which I was confined since the 20th of Jany., having abated, ... I proceeded on 11th February 1816 by the Timli pass to the Doon. ... I reconnoitred the ground near Beit (Saharanpour), which I thought might perhaps be sufficiently level for a base, but found it not so, & as no answer had arrived...to my application to...charge the extra expenses ...on the measuring a long base in a correct manner, and as the season proper for such an operation was passing away, I resolved to think no more of the base this year, but to use differences of latitude of places very distant from each other (but nevertheless visible)[1].

Marching through Kālsi, where the Jumna breaks out from the hills, he took a long series of observations from Singhori[2]—for latitude—to the hills around—and to snow peaks. "I mean to go to the summit of the lofty Chour-ke-Dhar[3], 5 days journey hence over high mountains". Passing through Nāhan, capital of Sirmūr, he reached the Chaur, 11,966 feet above the sea, on 21st April, and started another long series of observations [II, pl. 10; III, 175]. He found that work on these hills after fever was very trying ;

Whether it be from the changes in the atmosphere on high mountains, or the inconvenience of being exposed to severe cold & high winds, I find my observations never agree a fourth part so well as on the plains. ... Had I not been disabled by the dangerous inflammation of my throat, I could have taken a series of stars by the circular instrument, but on the 28th April I was obliged to go down to Nahan to consult Dr. Russell[4]. ...

28th April. Camp on the Chaur Medur mountain. Snow. ... A heavy fall last night. I purpose going to Sabatoo, & thence Rampoor in Bussair[5] [40 ; pl. 5] high up on the Suttleez. Should there be a mountain barometer to be sold in Calcutta, I should be greatly obliged by your buying 2 for me [34, 222][6].

In May 1816, he marched through Nāhan and Sabāthu to Simla, where he pitched his tent on the ridge, and found villages distant and supplies scarce. He then went along the track now known as the Hindustān–Tibet road, through Theog and Matiāna, to reach Kotgarh[7] on 27th May [pl. 5].

As soon as I am relieved from the inconvenience of an inflammation of the throat, caused by the frequent changes from the heat of the vallies & the cold dry air & cutting winds on the high mountains, I mean to survey by Rampour & the valley of the Suttluj along the foot of the Himalya, & to visit if possible the source of the Suttluj, as that cannot be done except in June or in the rains. ...

Ensign Garstin, assistant surveyor, is on sick certificate at Nahan. Ensign Paton joined me at Sabatto, & accompanied me to this place. He will be detached to survey the route to Bullaspour & Subathoo by the Suttluz. Ensign Garstin, when able, will be employed in a survey of the districts between Sabattoo & the Suttluz, and both the assistants generally in filling up details between fixed points.

The want of mountain barometers I greatly feel ; the last I had was broken on the Chour. I have two coming from England ; they are not procurable in India, either from the public or in the shops[8].

Leaving Kotgarh on 8th June, Hodgson travelled by Rāmpur and up the Sutlej, finding supplies very difficult as there was great shortage of grain. Before the end of the month he crossed the Shatul pass, 15,555 ft., over the high snow range to the upper Tons, returning to Kotgarh over another pass by 15th July. The following extracts from his journal describe this notable journey ;

By determining the position of the Kylas peaks[9] [I, 71 ; II, 81 n.4]...I shall determine the course of the Suttluz so far, & beyond it I believe the country is not inhabited. ... As to the source of the Suttluz, I hope to give more satisfactory information hereafter, but am greatly inclined to believe it is not in the Himalya ; the people universally say that it comes from near...Mansorar Lake ; some pretend to have gone along it so far ; one man whom I examined...gave me a description of the lake [II, 80].

23rd June. Burrah, towards the pass over the Himmalya into Swarra[10]. ...

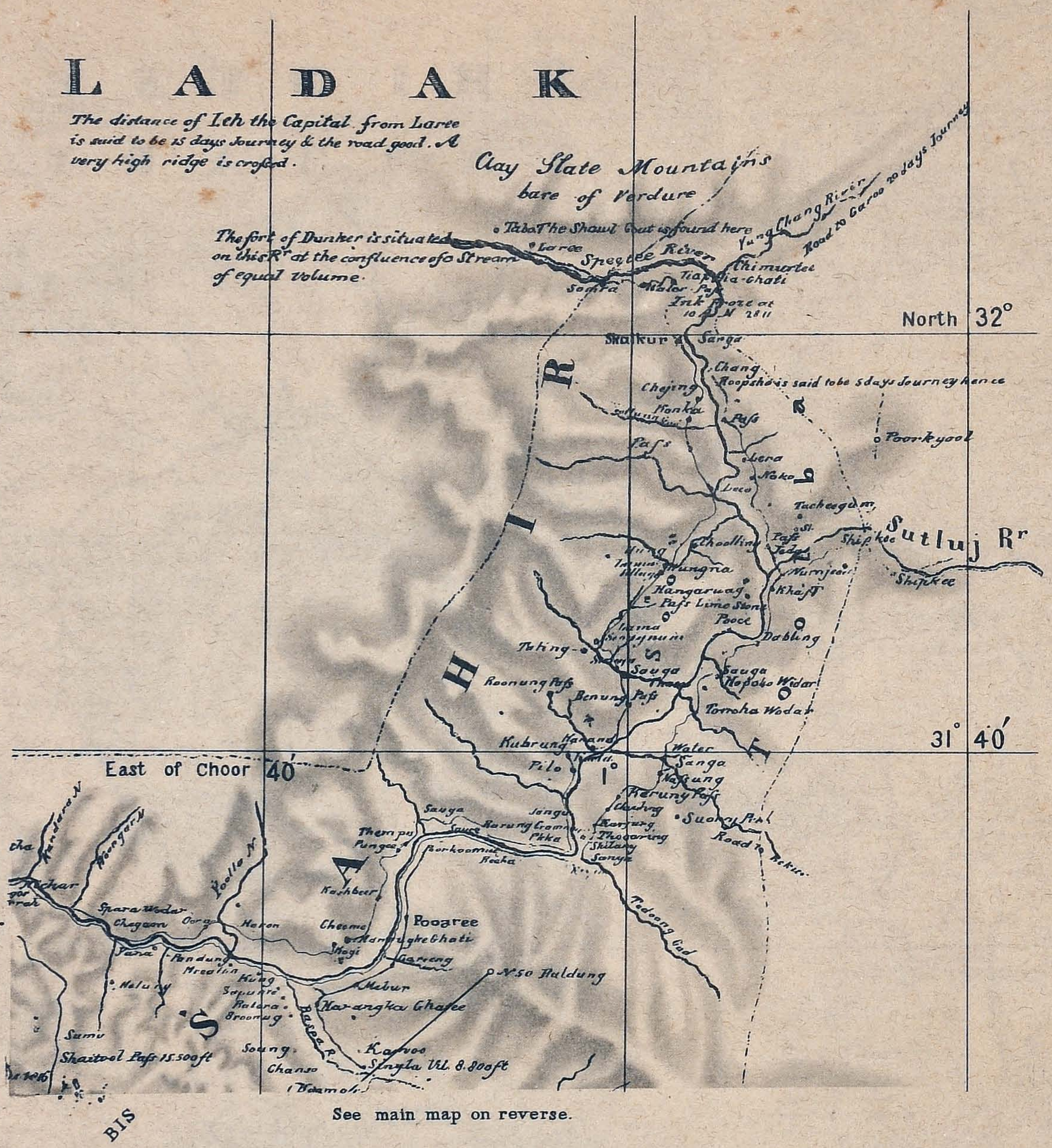
24th. Halting place above pine forest to...foot of pass. ... The Kylas Peak seen hence somewhat resembled the form of the Pegue temple of Sheo-Mahadeo, rising from a broad base, &

[1] Fdbk. MRIO. M 359 Feb. 1816. [2] 7632 ft., N. of Barat. [3] 53 F/5, conspicuous from Simla. [4] Fdbk. M 359. [5] Rāmpur, 53 E/11. [6] Letter to Hyde, ASG. DDn. 136 ; M. 575. [7] Summer hdqrs. of detachments of 1st & 2nd Nasri Batt. [40 n.5]. [8] MRIO. Fdbk. M 359. [9] Kailas, 22,028, 62 E. [10] Shaora ? on upper Tons, 53 I.

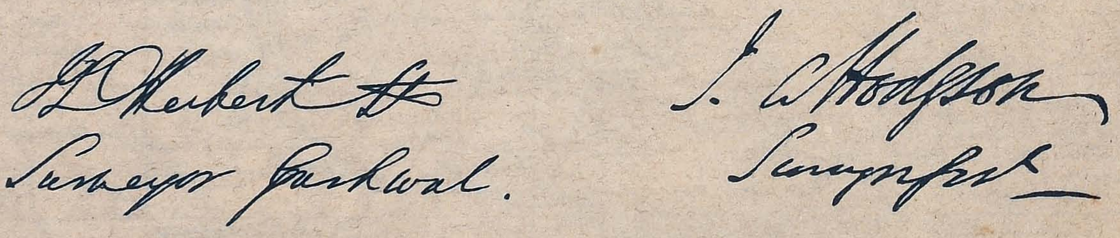
20' West of Choor
0°
20'
40'
1° 20'
For extension north see reverse.
East of Choor
MUNDEE
SOOKET KOOLLOO
BISSAHUR
CHINESE TARTARY
20 North
Sutluj R.
Rampoor
Kotgurh
Subathoo
KEONTHUL
JOOBUL
The Choor
SIRMOOR
Jownsar
Bowur
Kedarkanta
GURHWAL
NAHUN
Kyarda Doon
Dehra
Sreenugur
Ganges R.
SEHARUNPOOR
HURDWAR
Gungootree
Kedar Nath
Source of Ganges
Sree Kanta
The Pyramid
Tunjoogee Nurach
Nalphputun
31°
30°
40'
20'
Meridian of Choor 77 28' 30"
Jumna R.
To Peak A 3
To Peak A 1 (Nanda Devi)

GARHWĀL & SIRMŪR

Northward extension shewing Spiti R.



See main map on reverse.



Reduced from 8-mile map prepared in Surveyor General's office, 1822–3, from surveys of Hodgson, Herbert, and Oliver, 1816–22 [29–40]. Meridian lines drawn at 20′ intervals from meridian of *The Choor*, assumed to be 77° 23′ 30″ East of Greenwich. Survey was started from the observed latitudes of stations at *Belville*, *The Choor*, *Baraut* and *Soorkunda*. Owing to discordant results caused by the unsuspected vagaries of local attraction [35, 177], Herbert measured a base-line early in 1819, one mile east of Dehra [37 n.7], and with Hodgson compiled a quarter-inch map on the triangulation values thus revised [38].

For exploration of Himālayan passes and of Spiti and Sutlej rivers by Hodgson, Herbert, and Gerard, see pp. 30–1, 40–3, and Gerard's frontispiece maps, Lloyd, I & II.

Full triangulation charts appear as plates III & IV, *Asiatic Researches* vol. XIV.

Photograph by Margot Heaney
15th March 1951

Yard stick, R. H. Phillimore.

Surveyors' Stone, Bhadrāj Hill, 9 m. west of Mussoorie, lies 30 yards east of *fakir's* hut on lower summit, 440 yds. w. of point 7320. Bridle track from Cloud End passes between these summits. Initials cut include

I S B. (John Stephen Boldero (1791–1858), BCS., Jt. Mte. Sahāranpur, from 1815).

R D G.?

W L G (Wm. Linnaeus Gardner) [32 n.2].

I A H (John Anthony Hodgson, who climbed Bhadrāj in 1814 and 1816 to observe snow peaks [II, 83, 407; pl. 10; III, pl. 5]).

A G (Alexander Gerard [III, 22–3; pl. 3]), and a name in Persian script.

In lower right corner is

Lady Hood 1814 (Maria, wife of Admiral Sir Samuel Hood, comdg. E.I. Squadron [II, 83, 407]).

Fanny Parks tells of riding out to Bhadrāj *c.* 1835, *Wanderings of a Pilgrim* [II, 247–8]; "A little further on we found a Hindu idol rudely cut in stone; this idol is now neglected. ... Near it is a large stone on which is chiselled 'Lady Hood 1814'. On speaking of this to the political agent, he laughed and said, "You were more enterprising than Lady Hood—you visited the spot—she only sent a man to chisel out her name and that of Colonel B. on the top of Bhadrāj; she never visited the place in person".

The hut contains, 1951, two stone images, and a holy man was living here as late as 1930.

Printed at the Survey of India Offices (H. L. O.)

decreasing by steps as it were. There are other peaks near called Kylas, but this is the most eminent. ...

Abandoned my small tent, to allow the people to help on those who were falling down sick. ... Whether from the thinness of the air, or the exhalations from certain plants, very many of the people were attacked with faintness & laid down ; I also experienced an unpleasant sensation & headache all this day. ... Halted for the night at the Pamori river.

Observations for latitude gave 31° 29′ 25″. At night was preparing to observe an immersion of J's satellite, when I was seized with giddiness & could not stand to the telescope ; but it was misty, & probably the observation would not have been good.

I found that water boiled here at 188° of Farhenheit. The water was in a kettle in high ebluition. I ordered the people to take wood in the morning to the top of the pass, & to await my arrival there, that I might try this same experiment there with boiling water, but had the vexation to find they had gone forward to avoid the snowstorm there. I find it boils at Koteghur at 196°.

25th[1]. Halting place across the pass in the Himalya into Swarra. ... 26th. To Roul village. ... 1st July. Into the Pabur valley[2].

He wrote to Hyde on 1st July from

Camp at Rooron[3] on the Pabrot River, Bussahir. The survey is going on into...the rains if the thick weather does not oblige me to give it up. I must bring up my indoor work in the cold season below, when these mountains are buried in snow.

I have surveyed up Kunaur[4] [40, 43], the valley (or rather chasm, its so steep)... through which the Suttlez flows, one of the most rugged countries in the world to have inhabitants. I went up as far as I could get grain for my people, but at this season the poor crops of barley are yet green, and the people cannot grow enough for themselves, & are obliged to import it from the south side of the Himalya in exchange for wool. ... I purpose shortly to go up into Kunaur again, and higher. As I went by the course of the river, I got within the Himalya without passing the snow, but returned south over the snowy mountains into Swarroa.

There are 2 ridges of the Himalya, between which the Suttluj flows near east and west. I came over the southern one, which I crossed on the 24th at noon, and found it a very arduous undertaking. ... The want of barometers most mortifying indeed ! Even at this season people frequently perish there, & I found one dead, & with difficulty preserved the lives of several of my people, with the loss of some of my baggage.

Pray tell Col. Mackenzie the above when he arrives, & that I have preserved some of the rock of the Himalya for him, & have collected some flowers, &c., which grow below the snow for the botanical professor [48 n.2]; they are chiefly such as grow in the spring in England. I wish I had a skilful native gardner from the botanical gardens with me to collect plants & preserve them, as I am no botanist.

He asked for an astronomical quadrant :

Pray...mention this urgently, also a supply of barometers, &c., in a public way, as without Government will help, 'tis in vain to run the risk of breaking one's neck, or being starved or frozen to death. I hope when Col. Mackenzie comes he will set these wants in a proper light, for 'tis a shame that a great Government should have no better instruments in their store than those sent to Mr. Garstin ; so bad & rough that I really would not myself be at the expence of carriage for them [212].

Mr. Paton is employed at Hindoor. Mr. Garstin I believe sick at Nahan. I suffer greatly from inflamed sore throat[5].

From Kotgarh he returned to Nāhan, where he stayed from 10th August till 20th September, taking lunar observations for longitude when rain permitted.

I was also engaged in bringing up the map, but having doubts as to the precise latitude of my grand station on the Chour, on which everything depends, I thought it best to defer doing anything definite till I could revisit the peak.

This he did during October ;

At a place like the summit of this vast mountain...no one who has not resided in such a stormy region can have an idea of the violence of the wind, and the suffering of an observer by night from the cold, always much below freezing point. ... On the 10th of October, water instantly froze when poured out at 9 in the morning, tho' the sun shone out, the thermometer being then at 31°. Judge then what it is by night, accompanied by a wind which peels the

[1] date also entered in map; MRIO. 10 (18). [2] Pabar R., 53 E/SE.; MRIO. M 359. [3] probably Rohru. [4] Kanāwar is upper subdivn. of Bashahr state, covering upper Sutlej valley [pl. 5]. *Imp Gaz.* VII (49-5). XIV (372-3). [5] DDn. 136, M 575, 1-7-16.

skin from the face, & blows with a violence which seems to shake the very ground. I had a tent cut open to the north & south to protect the instrument, but at the time of observation the wind rushes in & shakes the instrument, & blows out the lights & creates confusion, & people holding the tent to prevent its being carried away are apt to touch or shake the stand, so that I found it impossible to keep the adjustments in order from night to night, and am obliged to reject some pairs of observations, taken with so much trouble.

As winter was coming on, he now moved down to Sahāranpur where

I repeated the observations for the altitudes & azimuths of the different snowy and other peaks, and took many new observations, & have, from the Chaur & Saharanpoor, points in the Himalya which Capt. Webb will also have [46, 47 ; pl. 6], so that our triangles will join and show the difference of latitude & longitude of a vast tract of country from the Jumna to the Gogra. ...

I hope to close this station by the end of November. ... I will then traverse to the east towards Bareilly, and fix the positions of places in the doab & Rohilcund *from* the snowy peaks, as it is no use remaining in the deep and dark glens in the mountains in the cold season. ...

About February I will again enter the mountains, and remain there...till next cold season, & if I receive the mountain barometers...shall, I trust, do much & well [30, 204, 222][1].

He worked down into Rohilkhand ;

24th December. At Moradabad the thieves carried off the large & excellent Dollond's theodolite, having also the telescope & every requisite. They also stole a double barrelled rifle gun from me. I was using this theodolite and, deprived of it, I could do nothing till I should arrive at Bareilly. ... The police in the neighbourhood of Moradabad is very bad.

He reached Bareilly on 26th December, and compared the bearing and distance with those used by Reuben Burrow [I, 160] and Colebrooke [II, 68] ;

At Col. Gardner's[2] camp, the snowy peaks, A1 & those east of it are visible. I erected (as usual) a pillar of masonry for the circular instrument, to observe them when the weather should clear up. ... A is the high peak of Jowahir, & is the western peak of Capt. Webb's survey, & the eastern one of mine ; it is very conspicuous, & visible from most parts of Rohilcund & the upper doab[3].

The views of the snows are at their best on clear days in January, but later become obscured by dust haze, as noticed by Lord Moira, 27th March 1818 ;

We now halted at Pusah. ... Rain having fallen in the night, I this morning saw again the glorious range of mountains which separates Hindostan from Tartary [II, 89]. At this season, though the air seems perfectly clear, there exists a haze which prevents even any dim adumbration of the mountains from being perceivable, unless after cooling showers[4].

On his return through Morādābād Hodgson turned aside to meet Webb who was making good progress with his survey of Kumaun [46] ;

Tho' I was anxious to return to the westwards, I thought a few days would be well bestowed in going up towards Rooderpour to meet Capt. Webb, that we might fix on some peaks by which our surveys could be connected. I accordingly went up, & we fixed on A & D′, and concerted other matters. I also re-inforced my already valuable collection of instruments with an excellent chronometer & a 42″ Telescope.

27th January. ... The Company's factory, near Kashipour[5]. ... I came up here and observed the great peak A. I must remain here some days until I receive an additional valuable chronometer & other instruments...for which I have sent to Almora[6].

He got back to Sahāranpur on 15th February and halted there till 26th, when he started out to the hills, determined to reach the sources of both the Jumna and the Ganges. He was encouraged by the promise that he would be joined by James Herbert, for he had been working single-handed for a long time, Barton, Garstin, and Paton, having all dropped out during 1816 for one reason or another [II, 381 ; III, 346–7]. He knew that he would not be the first European to reach these celebrated spots, for both had been visited two years before by James Fraser [II, 78, 398] ; but he intended to be the first surveyor to do so.

24th March 1817. I shall go on to Jamnoutrie[7] as soon as the path is open, but I fear the uncommon quantity of snow...will shut up Gangoutri this year ; however, if Herbert gets up, & we can repair the barometers, I may try ; without them nothing satisfactory can be done. ...

[1] Fdbk. M 360, 15–11–16. [2] Wm. Linnaeus Gardner (1770–1835) [pl. 5 n.] ; Ens. HM. 63rd Foot, 1783 ; in Marātha service 1798–1804 ; raised Gardner's Horse 1809 ; m. 1794 by *muslim* rites ; large estates Khasganj ; Fanny Parks, I (183, 420) ; *As J.* XIX 1836 (47) ; Hodson, IV (567). [3] MRIO. M 360, 14–1–17. [4] Hastings' *Journal* (350). [5] 53K/16 ; Nanda Devi [46 n.4]. [6] MRIO. M 360. [7] at the head of the Jumna.

Baraut[1]. 26th. The heads of my work this month are—observations at Deyrah—survey from that to this—and observations here for a few days. ...

31st. Lakho Mundul. Latitude 30° 43′ 24″ by an indifferent observation as it was cloudy. I am now going to Jumnoutri & am within 10 days of it, but there is so much snow that I must tack about in places. ... At Baraut I was detained 10 days by snow & rain [pl. 5].

I hope to get also to Gangoutri. ... I mean then to cross to Bussair on the Suttlez, and remain there the heavy part of the rains, and after that & before the first heavy fall of snow to remount the snowy Himalya Range, if I receive the barometers in time.

Since I left Baraut...I have been obliged to bring on grain from Kalsi, these mountains being almost in a state of famine. ... I am doing much good to these hungry regions by planting potatos wherever I go, and thus assisting Lord Moira's wish to introduce them into the mountains. ... I found a crop of them on the summit of the lofty & inclement peak of Baraut, on which the snow had laid more or less since last November. ... This unlooked-for crop must have sprung from some potatos swept out from the cookroom of an officer who was a short time since posted at Baraut...2 years [ago]. I was so pleased with this discovery that I sent down by dawk two of the potatos of a larger size than usual...to Lord Moira. ...

2nd April. ... The exact lengths...I cannot asçertain ; the wheel could not go, and the man who counts the paces had fallen down ; indeed it rained so hard & was so slippery I could not pay attention to anything except my footing. ...

5th to 11th. Halt at Geirah in Banaut. As there is too much snow around to think of getting to Jumnoutri for...20 days, I cannot do better than to remain here a few days to try the rates of my chronometers by transits of stars. ... The last 2 days have been productive of vexation, as I lost the immersion of Jupiter's 1st satellite by a stupid mistake in looking out 2 minutes too late. ...

The women here are uncommon ugly & filthy, dressed in dirty ragged blankets; there being little at present to do in the fields, their whole employment, and that an active one, seems to be in catching the lice which swarm on them.

17th Bannassa to Kursalie[2]. This village is immediately at the south foot of the great Jumnoutri Himalya, and is the coldest inhabited place I ever was at ; the snow lays deep around & above, and below the village, and in it, except where swept away. The two grand peaks of Jumnoutri are not visible, being hid by the lower but nearer part of the mountain. The source of the river is only 3 or 4 miles distant [2].

He then describes the *minal* pheasant—the *gooral*, a wild goat—and the *thar*, a wild sheep—and on April 21st marched 7 miles to Jamnotri, the actual source of the Jumna ;

I could not ascertain the precise heat of the spring, but it was too hot to bear the finger in for 2 seconds. Here then is the head of the *Jumna*, on the south-west side of the grand *Himalaya* ridge, differing from the *Ganges*, inasmuch as that river has the upper part of its course within the Himalaya[3] [II, 77–8 ; III, 36–7 ; pl. 5].

After retracing his steps he crossed over to the Bhāgīrathi, or west branch of the Ganges[4] where he was joined by Herbert [II, 405 ; III, 2, 176].

Captain Webb's survey in 1808...was discontinued at Reital [II 74–7] ; I shall therefore only give an account of the course of the river above the village. ...

On the 19th May 1817, I was joined at Reital by Lieut. Herbert of the 8th Regt. N.I., who had been appointed my assistant, and from his skill and zeal the survey has received much benefit. Mr. Herbert came direct from Calcutta, and brought for me a pair of mountain barometers, but the tubes filled in England had been broken ere they arrived in Calcutta ; there were some spare tubes which we filled and used, but we could not succeed in boiling the mercury in the tubes to free it entirely of air. The height of Reital above the sea as indicated by our barometers is 7,108 feet [II, 453 ; pl. 9 ; III, pl. 5]. ...

26th May. Distances paced. ... Reached Gangotri. Much too tired to attempt to boil mercury in the tubes today. At night, having prepared the instruments to take the immersions of one of Jupiter's satellites, we lay down to rest, but between 10 and 11 o'clock were awakened by the rocking of the ground and, on running out, soon saw the effects of an earthquake, and the dreadful situation in which we were, pitched in the midst of masses of rock, some of them more than 100 feet in diameter, and which had fallen from the cliffs above us and probably brought down by some former earthquake.

The scene around us, shewn in all its dangers by the bright moonlight, was indeed very awful. On the second shock, rocks were hurled in every direction from the peaks around to

[1] Barat, 7406 ft. [pl. 5]. [2] Bānas to Kharsāli, 2 m., Upper Jumna. [3] MRIO. M 360 ; *As R.* XIV. 1822 (149). [4] Burrard & Hayden (183).

the bed of the river, with a hideous noise not to be described and never to be forgotten; after the crash caused by the falls near us had ceased, we could still hear the terrible sounds of heavy falls in the more distant recesses of the mountains.

We looked up with dismay at the cliffs overhead, expecting that the next shock would detach some ruins from them; had they fallen we should not have escaped, as the fragments from the summit would have flown over our heads and we should have been buried by those from the middle. Providentially there were no more shocks that night. This earthquake was smartly felt in all parts of the mountains, as well as in the plains of the N.W. province of Hindustan. ...

We had the curiousity to measure trigonometrically the height of the cliffs...and found it to be 2,745 feet.

31st. A most wonderful scene. The Bhagirathi, or Ganges, issues from under a very low arch at the foot of the grand snow bed[1]. The river is here bounded to the right and left by high snow and rocks; but in front...the mass of snow is perfectly perpendicular, and from the bed of the stream to the summit we estimate the thickness at little less than 300 feet of solid frozen snow, probably the accumulation of ages; it is in layers of some feet thick, each seemingly the remains of a fall of a separate year[2].

Hodgson calculated the height of his camp at Gangotri to be 12,914 feet above the sea[3]. His journal continues;

And here we were obliged to return! Had it been possible to have got across the chasms in the snow we would have made every exertion, so anxious were we to get on; but onwards their sides were so steep, and they appeared of such great depth, that I do not think it would be possible to cross them (this year at least) even if the snow were not, as at this hour, soft, & the bottoms of the chasms filling with water.

On our return we were detained 8 days at Sookie, then we proceeded by Reital to Barahaut, from whence the survey continued down to the Doon valley[4]. Rains set in with violence.

No volcanos were seen or heard of in these mountains [II, 87][5].

The surveyors now withdrew to work up their maps and computations at Sahāranpur. As the weather cleared in October, Hodgson started observations "from a very steady pillar of masonry" to the snow peaks—and for latitude—whilst Herbert was sent to the Chaur for the same purpose [176]. They burnt white lights at each station for reciprocal observation.

Growing restless at being kept out of military service whilst the war was on, they both got leave to join the Reserve Army [218 n. 3, 335]. Hodgson accompanied the advance column to Jaipur, and surveyed the route with the help of Ezekiel Barton, but returned in time to resume observations at Sahāranpur during February 1818. From now onwards he was much troubled by ill-health. During March

Lieut. Herbert & myself had employed ourselves...revising various calculations regarding the snowy peaks, & the astronomical observations we had taken, & in such other matters as I could attend to within doors (being lame of the gout & also suffering from the pain in my head); also taking the rates of my chronometers by the new transit instrument.

I had great hopes of being able to go to Bairaut, but finding...that there was no chance of my being able to travel, I thought it better to detach Lieut. Herbert alone; he accordingly marched on the 16th.

Herbert marched up via Timli and Kālsi, and spent April observing on the Barat and Bhadrāj peaks [23], and was then joined by Hodgson;

During the first week of May 1818 Lieut. Herbert & myself were confined by severe illness at Nahan, Mr. Herbert with a jungle fever, & I with the affection of my head and eyes. When able, we were employed in revising & making many calculations of which in this survey there is a most formidable quantity. ... Left Nahan on May 17th. ...

21st. I was not satisfied altogether with the angles taken in the morning on account of the unsteadiness of the wooden tripod on which the theodolite had been placed; I ordered a stone pillar to be erected, & in the evening repeated all those of most consequence.

The elevations & depressions are much more to be depended on than those taken yesterday, for on the wooden tripod the instrument will not remain level 5 minutes.

During May they worked up to the head of the Tons;

May 31st. ... To source of river. ... Very distressing ascent over huge blocks of stone

[1] See 53 N; Gaumukh at foot of Gangotri glacier, falling 17 m. NW. from Badrināth, 23,420 ft. [2] *As R.* XIV. 1822 (117). [3] *Govt Gaz.* 13–8–18; Hodgson's journal read at As Soc., 10–8–18. [4] Map, MRIO. 168 (34). [5] Journal, MRIO. M 360, 31–5–17.

piled in inextricable confusion. Mountains rise to left to a prodigious height, being part of the main range of the Himmaleh. ... Here we leave forest, tree or bush, but vegetation, either grass or lichen, extends much higher. ...

We are, as it were, at the foot of the snowy chain, & see the Jumnootree peaks rising on the left bank of the river to an altitude of 16 degrees.

Return to Wodar...in heavy rain.

They spent the rains at Sabāthu. Hodgson was far from well, and had left all recent observations to Herbert. He writes from Sabāthu ;

Tho' I have been during these two months on the ground of survey within the mountains, I was prevented by that distressing disorder in my head...from taking an active part. ... Lieut. Herbert & myself set out together to go to the Chour, but I suffered so much from my complaint, that I was obliged to relinquish the undertaking, as my sufferings were much increased by the cold & the mountain was yet in snow. ... I entrusted my valuable circular instrument to Lieut. Herbert...to make the observations, both celestial & terrestial[1].

In July he asked to resign ;

I will nevertheless consider myself bound to complete and send the calculations respecting the heights, distances, latitudes and longitudes, of the Himalaya peaks, so soon as my sight is strong enough ; but if it should fail me altogether Lieut. Herbert is fully competent. ... I have very satisfactory data, and the grand base[2], the difference of latitude of the 2 ends of which is no less than 3,186 seconds, as now determined from a multiplicity of observations [175–7]. The snowy mountains have never been observed from the extremes of so long a line.

The calculations will be made according to the methods used by the English and French astronomers employed in the measurement of degrees of the meridian, and due attention paid to the spheroidal figure of the earth as determined by them.

The only data wanting are a few more observations of altitudes made at stations as near as possible to the great peaks. ... Neverthless the calculations will in the interim proceed with such data as are already in hand[3].

In spite of this apparent confidence, Hodgson was really anxious about the precision of the work, and before leaving decided that it was essential to measure the base-line he had originally planned. He still had no suspicion of the real cause of his difficulties, which was the disturbing effect of mountain, or terrestial, attraction, which, some eighty years later, was proved to be abnormally irregular in this neighbourhood[4]. It was not yet generally recognized that latitude derived from astronomical observations may be a most unreliable means of calculating horizontal distance [177 ; pl. 5].

Continuing in wretched health, Hodgson withdrew from the survey in October 1818, leaving Herbert to continue alone [2].

GARHWĀL & SIRMŪR, 1818–9

Leaving Hodgson marooned at Sabāthu, Herbert moved to Kotgarh, and set out towards the upper Ganges, across the heads of the Tons and Jumna, intending to work back to the Dūn, and find a suitable site for a base-line.

Left Kotghur 31st July 1818, to explore the head of the river Jannubbe [36 n.8], which joins the Bhageerettee about 5 miles below Gangotri. I determined to proceed E. from Kotgurh, where I had in July taken refuge from the rains[5].

He crossed the range east of Narkanda into the Tons basin by a pass which was considered one of the 2nd or 3rd passes into Tibet. Neither this one or any of the others had been yet examined by Europeans ; indeed, previous to the commencement of the present survey, the existence of such passes had not even been suspected, if we except that of Niti [II, 80 ; III, 47], the Himmaleh having been always supposed to form an impenetrable barrier between Hindoostan & Chinese Tartary[6].

Having no barometer, I had recourse to the method of boiling water, & tho' the thermometer...has a very small scale, yet...the results are nearly as much to be depended upon as those obtained by a barometer.

[1] Journal, MRIO. M 380. [2] Sahāranpur–Chaur. [3] DDn. 152 (56), Sabāthu, 14–7–18 ; diagram of triangles *As R.* XIII pl. iv.p. 224 [pl. 5 n.]. [4] Survey of India, *Professional Papers 5, 14* (chart I). [5] Plot of route, Kotgarh to Kedarkanta, MRIO. 13 (29). [6] though often crossed by Jesuit missionaries [I, 68].

August 2nd. Passed the dismantled fort of Bagee[1], situated on the summit of a ridge jutting out from the Whartoo mountain.

12th. Cross Tonse on a sanga, or bridge of spars[2]. ... 15th. To the summit of Kedarkanta, a peak of considerable elevation, being in round numbers 12,000 above the sea[3]. ...

24th. Khursalie to Jumnoutri. ... Very difficult path along river's edge; ... go up bed of Beduee-ka-Gad, large stream 8 feet wide & deep. Vast precipitous craggs rise from the bed of the Jumna perpendicularly & almost meet at top.

To crest of ridge; here commences the grand ascent of Bhyro Ghattee. Exceedingly steep ascent up face of mountain; path bad & slippery. Much bikh, or wolf's bane[4]; fine strawberries & raspberries of several kinds. Still steeper ascent to crest of Ghattee Jumnootree. Equally steep descent. All clouds and nothing visible. Easier descent into bed of torrent to boiling springs, crossing Jumna on two loose spars, a passage of some danger. Vast masses of snow. Himalya Range rises above.

On 31st August he crossed into the Bhāgīrathi basin by the same route as followed by James Fraser in 1815 [II, 78]. Using snow, and with firewood specially brought up, he found water to boil at the top of the pass at 188°·8 Fahrenheit, and computed the height to be about 15,180 feet. From here he descended to Jhāla[5] where he was kept three days

by the inattention of the Rajah's mootsuddee [162] whom he had sent for the purpose of assisting in procuring supplies, instead of which I found him invariably a hindrance. ...

The Bramin who had accompanied Capt. Hodgson to Gangotri came to wait upon me. ... He informed me that Lieut. Walker[6] of the 26th had visited Gangotri, & had endeavoured to penetrate to the head of the Bhageerattee, but had been prevented by the snow and the difficulty of the way. None however but Capt. Hodgson[7] has yet been able to boast he had seen the source of the far famed Ganges, hitherto so much obscured by fable.

11th Sept. The road had hitherto been along the right bank of the Bhageerattee. ... 1½ miles from Kopang we turned up...the Jumnabbe[8] river. ... The path gradually ascends & then leads along the face of the rocky scarp forming the right bank of the river, being part of the great Himmaleh itself. ... Frequently I was obliged to hold by the rock as I cautiously turned the corner of a precipice, fearful to look below lest my head had turned.

We encamped in the river bed on the banks of a small stream, ... A small piece of open ground sufficient to contain about two small hovels, almost overhung by the bare rocky precipice which rises above it—the river rolling by in its rock-obstructed bed—with the opposite mountain rising...far above the level of forests–such is the picture of Gurtag.

Sree Kanta[9], the peak, is also to be seen here, and affords an opportunity of settling the position of the place.

Crossing Chippila ghat about 800 feet above the river, the path then descends to cross the river by the Dadha sangar. This the Thibetans affect to consider the boundary, & conceive the crossing of it by a European to be an event of some moment. The people of Neilung are ordered to watch it & to report instantly any circumstance of this kind. I halted at an open...spot called Kurcha; although not more than 5 miles from Gurtag, such were the difficulties of the way that it was near sunset when I arrived.

12th. Cross an open corner of a precipice on a scaffolding; there are several of these. ... Cross first sango [*sup*], much worse than that of Bhyro Ghatee, being like that in an inclined position, but so much longer & consquently so much more elastic. It is very narrow, & the appearance of the river below, foaming over high rocks, is rather alarming[10].

On 13th September he reached the village of Nelang [42; pl. 5];

The villagers said that they had resolved on deserting the village when they heard of my approach. ... The Brahman however had persuaded them that no harm was intended, & that I would not proceed any farther against their will. ... Not only did they give me to understand that they considered my going any farther quite out of the question, but also that I should pledge myself that no European would ever again visit Neilang. ... I assured them that such an event was very unlikely again to occur; and that my only motive was curiosity...to explore the source of the river. This, however, is an object which these people do not understand, & they were...to the last very suspicious & anxious that I should return. ...

[1] 53 E/SE.; 10 m. E. of Narkanda. [2] on cantilever principle. [3] 53 I; 12,509 ft.; map, MRIO. 31 (70). [4] aconite, or monks-hood. [5] Lat. 31° 1′ 30″ N., 53 I. [6] Wm. Walker (1791–1824) Ben Inf.; Ens. 1806; 1st Nassiri Batt. 1816–8; d. Raingarh nr. Sabāthu 1824. [7] But what of Fraser? The MS. has a note in Hodgson's writing, "and Herbert, my companion & friend, the writer of this journal". [8] Jāhnavi R., or Jādh Ganga, 53 M. [9] Srikānta, 20,120 ft., 53 J/NE. [10] For country N. of Gaumukh & Gangotri see 53 M (1940), N (1936).

I then made some enquiries as to the source of the river, the distance of Chaprang [I, 68 n.10], with other particulars. ... They laid particular stress on the dangers & difficulties of the road, ... evidently with the view of dissuading me from attempting the journey.

I was fortunate enough to obtain an observation of the sun the last day of my stay, from whence I deduced the latitude to be 31° 6′ 49″. The longitude probably 79°[1].

Contrary to Major Rennell, who places his southern branch of the Ganges in the neighbourhood of Chaprang [I, pls. 6, 7, 14], these people assured me they knew of no river in the interior, & stated positively there was not any that flowed near Chaprang[2].

He started back on 15th September ;

24th. To the summit of Oochoolaroo Peak[3], ... elevated about 14,000 feet. This was a most fatiguing march and could not have consumed less than 12 hours. Arrived on the summit about 10 a.m. on the 25th. Here I established a station for which the mountain is very well fitted, being close to the snowy peaks. ... Observed their azimuths and the angles of the Chour, Byrath, and Soorkunda, interior stations, as well as their depressions, and angles of elevation of the snowy peaks. This labour, as well as that of erecting a signal, consumed the afternoon of the 25th and forenoon of the 26th. ... I should have devoted more time to this work but...I was compelled to descend in consequence of the negligence of the Rajah's people in forwarding supplies. ...

26th. I reached, at 12 o'clock at night, Reithul, after a most exhausting march of 12 hours. ... I was prevented surveying the latter part...by night coming on. ...

27th, 28th, 29th. Halted for the twofold purpose of fixing this principal point by intersections, which was highly desirable, as many longitudes had been observed here by Captain Hodgson. ... I also employed myself in procuring the wood necessary for the construction of rods required for the measurement of a base[4].

He spent from 16th to 30th October 1818 at Sūrkanda [176 n.6 ; pl. 5] making similar observations, and a fine panoramic sketch of the snowy range[5] [39]. He then marched down to Dehra, reaching Sahāranpur by 20th November, to take up the important task of measuring a base-line.

The discordance that existed between the latitudes of Byrath and the Chour, and which the most careful determination had failed to clear up, ... increased by the results obtained at Soorkunda, rendered it quite impossible to prosecute the survey until a satisfactory basis could be established. ... A difference of 10″ on the scale of 4 miles to an inch was too considerable a quantity to be passed over, and as the results obtained both by me and Capt. Hodgson... concurred without exception in giving too high a latitude to the Choor[6], it was seen that, whatever the cause of the discrepancy might be, ... the measure of a base would be...the most satisfactory solution of the difficulty [2, 35, 177 ; pl. 5 n.].

He spent several days at Dehra,

employed chiefly on calculations, ... the mornings and evenings being devoted to the examination of the ground in the vicinity, with a view to the measurement of a base. So difficult a thing is it to run a line of any length free from obstacles, even in the Doon, that I was unsuccessful in my search.

He persisted until on 30th December he "succeeded after a great many fruitless trials in running a line free from obstacles extending 21,000 feet"[7]. He spent January and February in constructing apparatus, and clearing and measuring the base [197–8] ;

The labour attending this work was very severe...as I was without assistance of any kind. It employed me from daybreak till twilight in the evening, with the exception of an interval of 2 hours from 11 to 1 for refreshment.

During March 1819 he connected the base to his main triangles and then set out for another long tour in the hills, starting with a survey of Jaunsar [II, 90 n.13], now part of Chakrāta *tehsil*[8]. He passed the hot springs of Sānsa Dhara [II, 408] and possibly climbed the hill above Rājpur. He observed from the summits of Barat and Chandpur peaks, and on 17th May was on Hatu Dhar[9] above Narkanda before moving in to Kotgarh for the rains.

[1] Nelang, 31° 6′ 30″ N. ; 79° 0′ 32″ E. [2] Journals MRIO. M 362, GBO Lib. Aa-43, M 363. [3] Uchālār, 14,128 ft., 6 m. N. of Raithal. [4] DDn. 137, Journal, M 322. [5] Original and copy, MRIO. Misc. 6–O–27 ; 10 (21). [6] Deflections of plumb-line ; Sahāranpur 15″ ; Chaur, 36″ ; Barat 39″ [177]. [7] Line shown on MRIO. 10 (19) ; N. end between Raspana Nala and Dehra ; S. end near Rāmpur on Bandel N. ; DDn. 137, M. 322, 30–10–and 7–11–18. [8] Jaunsar Bāwar, originally part of Sirmūr ; 1815–20 under pol. ch. of Resdt. Delhi ; from 1820 under Supdt. Dehra Dūn ; Williams (165, 176). [9] or Whartoo, 10,510 [36 ; pl. 5].

For an invalid I should suppose a residence at Kotgurh would be fully equal to a voyage to the Cape or New South Wales, having not only myself experienced the greatest benefit from the air and climate, but seen it in the case of others, even where the patient had been much reduced by a long protracted illness[1].

After two months at this delightful health resort, he spent eleven weeks from September 1st on a detailed survey of the upper Sutlej, taking as companion Patrick Gerard, brother to Alexander [II, 402].

GARHWĀL & SIRMŪR, 1819–22

Herbert started out again from Kotgarh on 2nd December 1819, working down to Sahāranpur via Sabāthu and Nāhan. He was now joined by Thomas Oliver and two apprentices who had been with Gerard[2] [22–3, 360]. At the end of March he set out through Hardwār to survey Garhwāl;

On the 27th March I arrived here [nr. Hardwār] & have halted with a view of settling the position of this principal point, & of seeing the great periodical fair called the Koomb ka Mela. ...

All the hill men, both here and in the neighbourhood having fled in an alarm caused by a fatal accident which occurred during the bathing, & by the breaking out of the cholera morbus amongst the people & troops, it is only today that the Raja of Garhwal[3] has with much difficulty procured me a few people, with whom I intend proceeding tomorrow morning towards Deoparyag, the confluence of the Alaknanda & Bhageerettee [I, pl. 6 ; III, pl. 5].

My object in choosing this route is, besides laying down the lower...course of the Bhageerattee, to fix the boundary of Gurhwal in this quarter, as being the limit of the survey. ...

Captain Oliver is with me, & would no doubt be able to afford me the greatest assistance but from being unfortunately unprovided with instruments, those indented for last Novr. not having yet reached us. He is in want of a road theodolite, or surveying compass, a perambulator, a telescope & chronometer. The apprentices, Graham & Fraser, I have been compelled to leave at Saharunpoor [371–2][4].

Returning to Sahāranpur, he was joined by Hodgson on 17th August 1820, and they set to work to re-adjust the computations, and polish up the map [39 n.11 ; pl. 5]. They also collaborated in preparing a paper entitled *An Account of the Trigonometrical and Astronomical Operations for determining the heights and positions of the Principal Peaks of the Himalaya Mountains*, that was read at a meeting of the Asiatic Society at Calcutta on 17th February 1821[5]. They claimed "the highest of the snowy peaks within the limits of the survey...to be 25,589 feet above the sea"[6], and "twenty peaks more elevated than Chimburazo, the most lofty summit of the Andes".

Herbert pursued the determination of heights, and in August 1821 made a series of barometrical observations at Sahāranpur, corresponding with observations made by Hodgson at Calcutta, and deduced the height of his observatory at Belleville[7] to be 1,013 feet above the sea[8].

In September 1821, Hodgson, who was now Surveyor General, asked for Herbert's appointment as Assistant Surveyor General at Calcutta [2, 309];

He is at present at Saharunpoor, engaged in adding...to the large map. ... What remains to be done...between the Ganges and Sutlej is not much, ... and I think that the field operations may be closed at the commencement of the next rains or sooner. To effect this duty ...Captain Oliver...is very competent[9].

At the end of October Herbert handed over to Oliver,

pointing out those parts which remain to be filled up. I have...delivered the whole of the instruments...to him with the exception of the mountain barometers and the protractor. The former I...propose making observations with on my way down. I shall leave this place on

[1] Journal, M 367 ; GBO Lib. Aa-44. [2] Simon Fraser and John Graham. [3] Rāja of Srinagar, ejected by Gurkhas 1796 ; restored 1820 ; Williams (177). [4] DDn. 152 (139–40), 17–4–20. [5] *As J.* XII. 1821 (361) ; *As R.* XIV. 1822 (60–152, 188–363) ; plan of trgn. 1821, *IO Cat.* (35). [6] Kamet, 25, 447 or Nanda Devi, 26, 645. [7] Magistrate's bungalow 1 m. S. of Sahāranpur ; MRIO. 10 (18) [II, pl. 10 ; III, pl. 5]. [8] true height *c* 903 ft. ; Fdbk. MRIO. M 358, which gives list of stations with geographical values. [9] DDn. 126 (86), 12–9–21.

the morning of the 31st instant, to proceed by water. ... Mr. Fraser has joined Captain Oliver at Kurnal, from which place they will proceed on the 1st towards Loodheeana[1].

To Oliver he wrote ;

The principal blank in the map...is the state of Joobal, through which only one route has yet been surveyed. The Pinjore valley is mostly wanting, and a portion of the valley of the Girree...to its confluence with the Jumna in the Doon. ... A few details are required in the Dehra Doon between the cantonment and Hurdoar. ... That part of the Bhageerettee between Rikikhes and Deoprayaga, and again between Barahat and Godee Ghat, are wanting, as much also of the Uluknunda as lies within the limits of this survey, which does not extend eastward of Gurhwal [II, pl. 9]. The dooab of these rivers likewise requires filling up. These, with a few details not of much consequence in Jownser...between the Jumna and the Ganges, and at the head of the Kyarda Doon[2], comprise the whole of the unsurveyed portion [pl. 5]. ...

I would suggest that you should in the first instance proceed from Kurnal to Loodheeana, that being a route much wanted. ... The correct position of Sirhind is a desideratum, as is also that of Loodheeana, and to fix these two places the snowy peaks, whose positions I have given you, will afford, if visible, unexceptional means. ... At Loodheeana...the azimuths of all the snowy peaks visible should be observed, and a sketch made of their outline. It would also be interesting...to ascertain the discharge of the Sutluj at that place, by determining the velocity, breadth, and mean depth.

From Loodheeana the survey might be prosecuted to Ropur[3], connecting, if possible by trigonometrical observations, the levels of the river [Sutlej] at those two places. A route from Ropur to Nahan, occasionally diverging to right and left, would lay open the Pinjore valley[4]. ... The head of the Kyarda Doon might be then laid down, with any remarkable passes leading from it into Sikh territory. ... From...the Doon, operations might be continued through the Kyarda pass and Sikh country to Saharunpoor, where January being a cold month...might well be occupied in protracting.

By the 1st February operations might be again commenced...by the Kansurow pass into the Doon to Rikikhes, ... and to Sreenuggur or higher. ... The operations in Joobul will consume perhaps a month or even more, and I think by that time the approach of the rains will render it expedient to think of halting. ...

Attention to the boundaries of the hill states...with their...purgunnas should always be kept in view. ...

The levels of the...rivers ought always to be observed when circumstances permit, as also their breadth, depth, and velocity ; the elevation of passes...are also desirable. For these, barometrical observations will answer sufficiently well...where corresponding observations are procurable ; but if not, they should be connected with the nearest of the trigonometrical stations[5].

Oliver completed the greater part of this formidable programme. He surveyed up to Ludhiāna by 3rd December 1821, and through Rūpar to Sabāthu by the middle of the month[6], being held up there by wintry weather. He then worked to Bilāspur on the Sutlej[7]

12th January. This march appeared to me much longer than the perambulator indicated ; descent from station 6 to station 7 was twice the length stated above. The perambulator knocked up the next day, and it is not unlikely that it may have ceased acting some time during the march. My road theodolite was dashed to pieces, & I was obliged to use the large one belonging to Government[8].

He was surveying through the eastern Dūn at the beginning of June, whilst his assistant Graham [38 n.2] worked from Sahāranpur to Rūpar via Ambāla, returning through Kiārda and Dehra[9]. The survey was brought to a close in June 1822. The maps completed at Calcutta included one on scale 4 miles to an inch with title *The Mountain Provinces between the Rivers Sutluj & Ganges, & bounded on the North by Chinese Tartary & Ladak*[10], and a reduction to 8 mile scale which was signed by Hodgson on 20th April 1823[11] [pl. 5].

Besides Herbert's panorama of the snows taken at Sirkanda [37] another was taken from the Chaur, using the same references, and fair copied at Calcutta

[1] DDn. 152 (170), Sahāranpur, 28-10-21. [2] Kiārda Dūn W. of Jumna, in Sirmūr State. [3] Rūpar, 53 B/9. [4] Pinjaur, 2 m. S. of Kalka. [5] DDn. 152 (166), Oct. 1821. [6] MRIO. 12 (46-52) six sheets on ½ inch scale. [7] Map, ib. 10 (16). [8] Journal & Fdbk., ib. M 368. [9] Maps, ib. 32 (68-73). [10] ib. 10 (18, 19), original & copy. [11] ib. 15 (36) ; 17 (58) [pl. 5].

under the title "Picturesque Section of the Mountain Provinces, with Geometrical elevations of the Snowy and other Ranges". It gives a table of comparison with other mountains of the world taken "from Mr. Humboldt"[1] [44, 46]. Badrīnāth is given as 23,441 feet above the sea, the present accepted value being 23,190.

The great surveyor Andrew Waugh has left the following comment on the work accomplished ;

> The survey of the mountain provinces between the Sutlej and Ganges rivers depends on a measured base & triangulation, the point of departure being astronomically determined, & the fundamental level above the sea by barometrical observations. An interesting account of these operations is given in the Asiatic Researches Vol. 14.
>
> The basis is highly creditable to the scientific ability of the officers employed and, having subsequently been connected by the Great Trigonometrical Survey, the results have proved satisfactory. But the interior filling is scanty and incomplete, and the drawing of the ground inaccurate and inartistical.
>
> It is to be regretted that a work so well commenced was so hastily concluded. Considering the time and means employed, no greater completeness could be expected ; but it can only be termed a first survey, requiring to be taken up again on rigorous principles. None but first rate draughtsmen can be expected to succeed in a mountainous country so difficult of delineation[2].

UPPER SUTLEJ VALLEY, 1817–23

Hodgson's journey into the Sutlej valley during 1816 has already been described [30–1], and both Alexander Gerard in 1817[3], 1818, and 1821, and Herbert in 1819, kept full descriptions of more extensive journeys [42–3].

The source of the Sutlej had long been a matter of speculation. The lamas sent out from Peking in 1711 had confused its upper reaches with those of the Ganges [I, 70–1 : pl. 7], and the legend that it came from the sacred lake of Mānasarowar was hardly heeded by European geographers until Moorcroft visited that lake in 1812 [II, 81].

For two hundred miles the Sutlej flows through the Hundes province of Tibet, until near Shipki it enters Kanāwār, the upper part of Bashahr State[4] [31], and flows past Rāmpur about 16 miles north-east of Kotgarh. Gerard's interest was led to this rugged gorge by visits to his brother Patrick, who was attached to the 1st Nassiri battalion of Gurkhas at Kotgarh[5] [37–8]. He was naturally glad to escape from his survey of Sahāranpur [22–3] to protract his maps in so delightful a climate.

In 1817 he left Sābāthu on 27th August, and passed Mahāsu on 31st, Kotgarh on 4th September, and Rāmpur on 8th. He marched up the right bank of the Sutlej and reached Rarung, 20 miles above Chini on 20th September. On his return he crossed the river at Wangtu and passed over the Shatul pass to the Pabar River, returning to Kotgarh on 5th, and Sābāthu on 14th October. He was accompanied part of the way by Dr. Govan[6], and surveyed his route by theodolite, perambulator, and chronometer.

In 1818 he left Sābāthu three weeks later, 21st September, crossed the Borendo pass from the south into the Baspa valley, and reached Shipki 12th October. He then crossed to right bank of Sutlej, climbed to over 19,000 on the slopes of *Purgeool*[7], and went up the Spiti River to Shalkar, 21st October. He was accompanied throughout this trip by his doctor brother, James, and they were back in Sābāthu on 22nd November[8]. They were well equipped for survey, which was fortunate, for they had several disasters on the road ;

[1] DDn. 152 (132), 11–2–20 ; MRIO. Misc. 21–O–19 ; with copy dated 28–3–42 and also pubd. [2] *PR.* (31) ; DDn. 542 (166), 20–10–50. [3] and possibly also 1816, *v.* Lloyd II (287). [4] *Imp Gaz.* VII (94). [5] 1st & 2nd Nassiri Batts. raised after Nepāl war with hdqrs. Sabāthu and dett. Kotgarh, and later became 1st Gurkha Rifles, the Malaun Regt. [6] George Govan (1787–1865), Crawford's *List* B 654 ; turned back at Meru, 18–9–17 ; *Koonawur* (191–267). [7] Riwo Phargyul, 22,210 ft. ; Burrard & Hayden (44). [8] *Koonawur* (271–308).

Our last three marches were fraught with accidents ; three barometers, a perambulator, and thermometer were smashed to pieces ; and the small theodolite, a very neat instrument by Dollond, divided into single minutes, with a brass stand, was rendered unfit for taking elevations, the nonius having broken off. We had remaining a strong perambulator, two large theodolites, a surveying compass, four barometers, and as many thermometers, together with a couple of sextants, a reflecting circle, and a chronometer, so that we were still very well supplied with instruments[1].

The narratives of both these journeys are given in Gerard's *Account of Koonawur*[2]. That of 1818[3] was read at a meeting of the Asiatic Society at Calcutta, and reproduced in the *Journal* of 1842, and also in the *Edinburgh Journal* of June 1824.

In 1821 he made a yet more enterprising journey. Leaving Sabāthu early in June, he and James ascended the Shatul pass from the south, and camped there on the 8th. He deduced a height of 15,556 by a Dollond barometer, as against 15,554 deduced by James the year before[4], the mean being still accepted as the official value. Keeping to the south of the great range, they visited the Yusu pass to the east, and then camped two days on the Borendo, before crossing to the Baspa valley to visit the Gunas and yet other passes. Here James had to return, and Alexander searched without success for a pass that would lead to Nelang [36]. He explored the difficult ridges south of the Sutlej and on 24th July crossed the *Keobrung* pass leading east, height 18,313 feet, longitude 79°, but was then held up by "Chinese Tartars", or Tibetans, from reaching his objective, *Bekhur*.

Recrossing the *Keobrung*, he worked north to Shipki, where he received a letter from the *Gorpan* forbidding him to proceed east. He crossed to the north bank, went up the Spiti to its junction with the *Parati*, and was again turned back by messengers who were friendly but firm. Returning to the Sutlej he crossed the Manirung pass to the north, and reached *Manes* on the road to Leh, but was not allowed to go further. Of this last effort he writes ;

The trip had not added much to our geographical knowledge ; Manes, Peenoo, and Dankur, formerly fixed on the report of the natives and laid down in the map, agree very nearly with their positions as now determined. The route is notwithstanding of great importance, as it verifies the accuracy of the statements given by the Koonawurees ; ... they may consequently be relied upon to greater extent as to remoter objects[5].

He now marched down the Sutlej to Rāmpur and reached Kotgarh on 24th September after a remarkable journey and the acquisition of much geographical knowledge[6] that he set out in clear maps[7]. He again had a wealth of instruments; two perambulators—three theodolites—two sextants—a reflecting circle—two mountain barometers—a fifty-foot chain—and a five-foot standard scale. He was master of them all ; at *Rukor* he writes ;

It was 2 h. 30 m. PM. when I reached camp, and at three the transit arrived ; it was immediately put up, and gave me excellent observations for the time. I find this is by far the best plan, and the only one when you do not reach your ground till afternoon, in which case it requires the latitude to be observed to a very great degree of nicety to get the time to accord ; but with the transit, operations are very simple.

A pillar is erected in ten minutes, and the transit is fixed within a few minutes of the meridian, levelled, and ready for observing half an hour after it arrives. By a short calculation (for I have got tables which reduce the computation at least two-thirds), if I get two proper stars which one seldom fails to do in these serene regions, I can obtain the time and deviation of the telescope, and thence the variation of the needle.

During my halt at Murung I had an excellent opportunity of comparing the results of the transit with those of equal altitudes, and the greatest difference was only once a quarter of a second. I saw stars of the fifth magnitude very clearly in the middle of the day[8] !

His memoir was read by Henry Colebrooke before the Royal Asiatic Society in London on 5th November 1825, and reproduced in their *Transactions*[9].

[1] *Koonawur* (293). [2] includes ¼-inch map by J. & C. Walker in pocket in front cover. [3] Lloyd, I (272) ; *As J.* IX. 1820 (587) ; *JASB.* XI (364–91). [4] when James lost two servants "frozen to death at midday". [5] Lloyd, II (258). [6] Narrative letters, ib. II (1–323). [7] Maps, ib. I, frontispiece, II (23). [8] ib. II (106–7). [9] Vol. I, part II ; see summary *As J.* March 1826 (333), & April 1826 (427).

He made another journey in 1822, in company with William Lloyd [II, 417] and others, that was more of a picnic party, described in *Narrative of a Journey from Caunpoor to the Boorendo Pass.* They stopped one night at Simla, and enjoyed vigorous air and the view of the snow peaks from "Herbert's observatory" at the top of Jakho [II, 417][1].

Now for the journey made in 1819 by Herbert and Patrick Gerard [40]. They left Kotgarh on 1st September, crossed south into the Giri valley, and on the 30th recrossed into the Baspa valley over the Gunas pass [pl. 5]. Then to Shipki by 14th October, making their furthest point at Lori [43] on the Spiti River on 26th. They were back at Kotgarh on the 16th November[2].

The following extracts are taken from Herbert's journals and from the account in *Asiatic Researches*[3], entitled—"Tour made to lay down the course and levels of the river Sutlej, or Satudra, ... within the limits of the British authority".

He was anxious to test the statement of the villagers of Nelang [36] that no great river such as the Sutlej flowed by "Tsaparang"[4] [I, 68]. Hodgson's journey of 1817 had proved the falsity of the old Lama version that this Kanāwar valley formed the southern branch of the upper Ganges ; confirmation was yet required that Lake Mānasarowar was the source of the Sutlej.

The Sutlej has been known lately to derive its source, if not from the lake Rawan Hrad, or the neighbouring one of Mansarovar, from the high ground on which they are situated. From the source, however, ... to Ropur [39 n.3], ... a distance of 400 miles, little was known concerning it or the country it flows through. Till the expulsion of the Gorkas gave facilities to research[5], the existence of a western branch[6] of this great river beyond the snowy chain was not even suspected. ...

Desirous of following a route which had not yet been examined, I determined to proceed by...Chepar in a S.E. direction, and afterwards, striking off to the north, to ascend the Roopin, or right branch of the Tonse, and find a pass over the Himmalya. ...

Our expectations of accomplishing the passage of the range were strengthened by our meetting a party...on the Tonse, who were returning with salt from...Kunnowr. They had crossed the pass about noon, & reported the old snow sufficiently firm. ...

Those who have travelled through such desolate & unfrequented parts will alone understand the sensation which the meeting with these poor...mountaineers afforded us ; the sight of even the first straggling sheep preceding the calvalcade was hailed almost as that of a friend. An animal, even a bird, any living thing in fact, serves to take from such a scene the almost...death-like character of solitude. ...

The total distance to the pass I have no means now of ascertaining, for the last few leaves of the route-survey...were afterwards blown from the book on the stormy summit of the pass.

Crossing the Gunas pass from the south, Herbert describes the open waste of snow and the exhaustion of wading through it ;

The servants & hill followers began to be alarmed at the length of the way, seeing no immediate termination of the wintry horrors that surrounded them. To add to our perplexity the sky became overcast ; black clouds collected overhead and, in a moment of anxiety and alarm, I thought I felt a flake of snow descend upon my outstretched hand. ... Fortunately my fears deceived me. ...

We reached the crest of the Gunas pass, extremely fatigued. ... Night was falling, the greater part of the baggage men had not started up the last ascent, ... so loads were abandoned, and the men were with difficulty brought over. ... Between 8 and 9 o'clock we at length reached a spot where a few stunted bushes of dog briar afforded us fuel to restore with warmth a little confidence. ...

Arrangements were made to bring in the few men who had spent the night on the pass. ... It was very satisfactory to find that, amongst so many, but one had suffered, a circumstance to be attributed in a great measure to the care I had taken in making them provide themselves with blankets, stockings, and shades for the eyes. This one man had neglected to defend his eyes from the glare...and was perfectly blind for a day or two [II, 65 ; III, 44 n.7]. ...

On promising a rupee for each load that should be recovered, the carriers set off in high spirits, and in the course of the day everything had arrived.

[1] Lloyd, I (139, 147). [2] MRIO. M 367 [38 n.1]. [3] ib. M 362, 367 ; *As R.* XV. 1825 (339–428).
[4] Chabrang Dzong, 53 M. [5] Gurkhas occupied Bashahr 1803–15. [6] Spiti R.

The following day Herbert went back to survey the 4½ miles he had been unable to survey on the 30th ;

It was a fine frosty morning ; so great was the cold that the ink froze, and forced me to write my notes in pencil. ...

As viewed from this spot, the Himmalaya is far from being a regular ridge, or single series of peaks ; they are seen in every direction, rising up from amidst the wilderness of snow that extends many miles in breadth. ... Beyond the Baspa appear peaks still higher than those of the ridge on which we stood. ...

It has been thought by some that the northern ridge is distinguished by the name of Kailas [30 n.9] while the southern retains that of Himmalaya, but I have not myself observed any distinction of this kind made by the mountaineers. It has rather appeared to me that they, as well as the people of the plains, call every high place by the term Kailas, and apply it equally to the southern as to the northern ridge.

On the 3rd they marched down the Baspa valley to Sangla[1] ;

We were now in Kanawar, a purgunnah of the mountain state Bissahir [40]. Kunawar comprehends the valley of the Setlej and its principal feeders. ... On the north it is co-terminous with the Chinese possessions, and on the west with the Tartar purgannah of Hangareng, also subject to Bissahir, with Ladak and with Kulu, now subject to Ranjit Singh[2].

From Sangla they turned up the Sutlej, but

from the jealousy of the officers on the frontier, the survey necessarily terminated at the limit of our authority. At Shipki, the first village of Chinese Tartary, I was compelled to retrace my steps [41].

On the way back they turned up the Spiti, and reached Lori [42] the first village of Ladākh, Herbert noting that "we had now reached the 32nd degree of latitude and had left the true Himalaya far to the southward". They returned over the Manirang pass to Sangnam, and thence back to Kotgarh[3].

A reduction of Herbert's map appears in *Asiatic Researches*. Latitude was observed at about 30 places besides a few longitudes from Jupiter's satellites, and several peaks were fixed by triangulation. It is typical of the times that we find no mention of exchange of information between Alexander Gerard and Herbert regarding their surveys of the Dūn and the Sutlej valley, though it is difficult to believe that there was no communication between them.

This appears to be a suitable point at which to mention Moorcroft's journey to Ladākh made in 1821 with Trebeck and Guthrie[4] with the ultimate objective of reaching Bukhāra by way of Yarkand. Leaving Bilāspur on the Sutlej in July, they travelled through Kangra, Kulu, Lāhoul, and over the Bārā Lācha pass, to reach Leh on 20th September. The route was surveyed, and astronomical observations taken, by Trebeck. A map by John Arrowsmith[5] is included in the account of Moorcroft's travels edited by Horace Wilson, who records that

the materials of the map are, first, the field books of Mr. Trebeck, minute, careful, and accurate. The measurement is made by paces, but the bearings by the compass are noted with great precision, and corrected or confirmed by repeated comparison.

The latitude of Le, of Kashmir, and various intermediate points determined by observation, and height of barometer and thermometer at principal elevations, [are] set down[6].

The latitude which Moorcroft assigned to Leh, 34° 9′ 21″, differed considerably from values previously given—the Lamas' map of Tibet, less than 31° [I, pl. 7]—D'Anville, 33° 20′ [I, 210]—Macartney, 37° [II, 271]—Buchanan, 36° 30′ [II, 70][7].

A map compiled at Calcutta, 1823[8], shows that it was controlled by latitudes observed by Hodgson, Herbert, and Trebeck, and quotes a letter from Trebeck to his brother in Calcutta[9] explaining an error in two sketches of his route to Leh that had already been submitted,

from a miscalculation of the latitudes, in which a correction of the sun's declination for longitude was omitted. ... [The result] differs not more than 3 or 4 miles from the true distance...

[1] 53 I, 78° 15′ E ; pl. 5 Singla. [2] Sikhs occupied Kashmir and Kulu 1821. [3] cf. Gerard's route two years later [41]. [4] Bo. Est. ; sub-asst. surgeon. [5] *IO. Cat.* (466), 1841, scale one inch to degree. [6] *Moorcroft & Trebeck* (lv). [7] True value, 34° 10′. [8] Original map, MRIO 12 (4), with copies 12 (3–6). [9] Chas. Trebeck, junr., attorney.

between Bilaspur and the capital of Ladakh, rather a near approximation considering the uneven and circuitous nature of the road.[1]

They stayed in Ladākh for two years, making several survey expeditions, whilst Moorcroft won a great reputation by successful operations for cataract. He had set his heart on visiting Bukhāra and, on being refused permission to travel via Yārkand, decided to attempt the journey by Peshāwar and Kābul.

Leaving Leh on 20th September 1822, they crossed the Zoji La and reached Srinagar on 3rd November. After various trips in the Kashmir valley they set out again in September 1823, and travelling via Pūnch, Jhelum, and Rāwalpindi, reached Peshāwar on 9th December, staying there over six months. After collecting a large caravan they went forward again in May 1824 and reached Kābul on 20th June. Their Kashmiri and Gurkha followers wisely refused to accompany them any further, and after six months hazardous travel they reached Bukhāra in February 1825. Falling sick on the return journey all three died some six months later[2].

Moorcroft's travels, as those he made in 1812 [II, 80–1], covered much ground that was entirely new, and contributed greatly to geographical knowledge[3].

It is not known who was the author of a letter dated Sabāthu 11th December 1823, published in the *Asiatic Journal*[4] of 1825 under the title of "Route to Ladak". The writer followed the Spiti River from its junction with the Sutlej to within 30 miles of the Bārā Lācha La, on the road to Leh. He describes the immense snow peaks, but greatly over-estimated their height, which would not be expected from experienced surveyors like Herbert or Alexander Gerard.

From the angles of altitude which I observed, their pale outline, and the broad outline of snow, they cannot be less elevated than 29,000 feet. ... As I had no time or place for fixing their position, I adopted Humboldt's plan of vertical lenses,[5] the results of which would give an approximation to their height. ...

From Sheealkur[6] onwards was new ground to me, and I was occupied in surveying. Our territory here confines upon China and Ludak. Sheealkur is part of Bussahir, but this state still extends a day's journey before it infringes upon Ludak.

He continued up the Spiti past the villages Dankhar, Lara, and Rangring, 12,000 feet above the sea ;

I surveyed, by the tract [*sic*] of the yaks, and got on pretty well through the snows—The reflection from the snow dazzled me, as I took no precaution for my eyes, and suffered dreadfully from its effects[7]—My hands could no longer point the theodolite, and I ceased surveying—Party exhausted some miles short of Lassar,[8] the last village—Here ended my tour, as it began, in disappointment—Leh still 10 days journey beyond me.

The writer returned by the way he came.

KUMAUN, 1815–21

Webb's previous experience marked him as well fit for the survey of Kumaun, the hill tract lying between Garhwāl and Nepāl. He had assisted Colebrooke in the survey of Rohilkhand, and led the expedition up the Ganges above Hardwār [II, 32–3, 73–7]. He then spent two years surveying northern Oudh and Gorakhpur before taking sick leave to England [II, 33–4]. While at home he attended courses in astronomy at Greenwich observatory, and returned to India with a battery of new chronometers just in time for the Nepāl war. He joined the force that occupied Kumaun [II, 90], and was appointed surveyor in March 1815[9].

Like Hodgson he started without measuring any base-line, but suffered no inconvenience from the vagaries of local attraction [35 ; pl. 6 n.] ;

A base was determined by astronomical observation, using the difference of latitude between its extremities and the true azimuth...for computing their distance, and upon this base

[1] dated Srinagar, Kashmir, 21–6–23. [2] *Moorcroft & Trebeck* (xlvii–ix). [3] Paper read at ASB. ; *v. Govt. Gaz.*, 12–5–25. [4] *As J.* XIX (629–33). [5] Baron Alexander von Freidrich Humboldt (1769–1854). [6] Shalkar, 53 I ; 15 m. above mouth of Spiti [pl. 5, Skalkur]. [7] Herbert would have been wise to this [42]. [8] Losar, 52 H ; on Spiti R., 77° 45′ E. [9] BGO. 23–3–15.

an extensive triangulation has been formed, which now connects Hurdwar with Tuklakot Pass in longitude 80° 48′ E.

It is remarkable that though Hodgson, Herbert, and Webb, were oblivious of the possible effects of local attraction, George Everest, only 15 years later, was fully aware of the danger, and classed Webb's survey as untrustworthy;

The survey of Gurhwal by Captain Hodgson and Lieut. Herbert...was commenced...on a base-line measured astronomically, but as that was not found to answer, the whole distances were corrected by a base line measured by Captain Herbert. This survey may therefore be considered as final, and quite sufficiently accurate for geographical purposes. ...

The survey of Kumaon...depends on a base measured astronomically, of 10 minutes. Now it is a well known fact that a base of such extent is liable, particularly in mountainous countries, to be affected by local attraction. ... We may state the probable error as 10″, which amounts in that latitude to 1,000 feet and upwards, so that about 100 feet per mile, in excess or defect, is the error to be apprehended.

This survey was carried on by...a trigonometrical process, but it cannot be comprehended under the term of a regular triangulation, for none of the triangles are symmetrical, the three angles are not measured, and errors of 40 feet per mile are of frequent occurrence, so that it is, on the whole, little better than what is called a wheel and compass survey[1].

By Webb's own account,

The number of stations, including those by the barometer, will furnish...more than four hundred points of elevation. ... The whole survey having hitherto devolved upon myself, and, being ill qualified as a draughtsman [II, 76, 453], my attention has been principally directed to the formation of the outline, and comparatively little to the map, in which I have been in continual expectation to be aided by an assistant.

But I have on all occasions surveyed the route by which I have travelled, and the distances since the first season have been measured by an instrument which I have found very convenient, ... resembling an open pair of compasses, whose points are just one fathom distant from each other. These several routes, with the exception of about 15 marches, ... will fill rather more than one half of the map of Kumaon upon a scale of about three miles to an inch[2].

His main interests lay in fixing the snow range, and exploring the Tibetan border land. By May 1816 he had surveyed to the sources of the Kāli and was working along the north border, trying to negotiate permission to visit Lake Mānasarowar [II, 79 ; III, pl. 6].

I considered that to pass churlishly along the frontier, prying into its passes and reconnoitring, would be more likely to excite...than to allay the jealousy already kindled, and therefore, to induce some friendly intercourse, I sent forward some of the Bhooteea[3] zumeendars to Tuklakot[4], desiring them to state to the Governor the nature of my...employment, and to express a wish...to be permitted to visit the lake Mansurwur, ... paying my respects to him personally.

The Chinese Governor, or *Dèba*, agreed to a meeting ;

May 28th 1816. The snow this morning was eight inches deep upon the ground, nor had the thaw become sufficiently effectual to admit of our proceeding towards Kalapanee till one o'clock. ... [rides a yak—meets the *Deba*—permission to visit Manasarowar refused; politely but firmly]. ...

The Viceroy of Gurdon [Kardam ?] who had disobeyed this order in favour of Messrs. Moorcroft and Hearsay [II, 80], had been removed from his situation with disgrace, and summoned to Oochung where, in all probability, further punishment awaited him.

The Chieftain remained with me near five hours ; sending for his pipe and large teapot, as seeming to consider me but an indifferent preparer of that beverage.

To Government's request that he would confine himself "to the work assigned to you"[5] Webb replied that "a proper degree of caution and discretion was observed" and promised that he would not "again re-enter Bootan till authorized to do so". His claim for Rs. 309-8-0 for presents was allowed.

In a letter of June 7th he reports that he had

visited the source of the river Kalee, and with imminent peril crossed the snowy ridge...by the pass of Lebong[6]. The extreme labor, great difficulty of respiration, experienced in the last undertaking, has occasioned a general sickness in my camp. I hope, however, to get

[1] DDn. 265 (303-8), 10-11-31. [2] DDn. 150 (53), 8-10-18. [3] or Tibetan [I, 23 n.5]. [4] 35 m. S.W. of Lake Mānasarowar. [5] BSC. 14-9-16 (35-7). [6] Lipu Pass, 17,890 ft.

the whole party under shelter tomorrow, and to accelerate their recovery...I purpose remaining stationary for some time.

He later reported that he had been detained "by unusually violent falls of snow about the equinox which confined me for many days in one of the southern villages of Dharma". He sent specimens of gold dust and articles of Tibetan produce[1]. Driven down to the plains by the winter weather, he met Hodgson at the end of January 1817 [32].

I have been employed during the past month in the teraei, or in situations whence observations of the Himaleea may be taken with the greatest advantage. Afzulgurh is the last of these, the debouche of the Ramganga, by which route I purpose re-entering the mountains[2].

His report for 1816 gave a list of 130 points with their latitudes, longitudes, and heights. It was read before a meeting of the Asiatic Society with Lord Moira in the chair[3], and tells of a peak of 25,669 feet, at 30° 21′ 51″ N.; 79° 48′ 39″.6 E., obviously Nanda Devi[4].

He reported on the 1st August that he had added at least one hundred further barometer heights, and was checking them by triangulation[5]. In December he sent a full account of his work to Mackenzie, who had now come up from Madras;

It seems necessary, during the present season, to establish by barometrical observations the height of that part of Rohilkhand from whence my elevations commence, ... hitherto... assumed by estimation only [47]. It is therefore my intention to visit the terrae either this month, or in January, in which I must be regulated by Laidlaw's approach[6]. ...

It would give me great pleasure to communicate at some length the general principles upon which my labours have been conducted, ... for, however flattered I certainly must feel by Colonel Crawford's having committed the whole arrangement to my own discretion, it would now be very desirable that you should review the work. ...

I am the more anxious on this subject as I know from literary friends in England that this survey has excited some curiosity there, and perhaps even beyond that country, as Mr. Strachey[7] procured from the Russian embassy, and forwarded to me from "Tibreez"[8] a number of "Le Conservateur Impartial" dated March 11th and printed at St. Petersburgh, which contains the following paragraph; 'Le capitaine Anglais, Webb, qui parcourt le nord de l'Asie, a, dit-on, ... traversé d'énormes chaines de montagnes couvertes de neige, regardées comme inaccessibles, et par lesquelles on peut ouvrir une route par la Tartarie jusqu'en Russie[9].

The preliminary reports of Webb's work had indeed created a stir. They called forth a favourable review *Sur l'Élévation des Montagnes de l'Inde* by Alexander von Humboldt[10] [40], but the accuracy of his heights was challenged by a writer in the *Quarterly Review*[11] [II, 88]. This sceptical attitude roused Herbert's wrath;

This survey involves as a principal point the determination of the highest range of mountains in the world, [as recognised by] all except such as at home think science confined to Europe, and that it is impossible for an officer in the Company's service to measure the height of a mountain. ... I think I may say the national honor is concerned, as well as that of the Bengal Army.

I...refer...to the very unhandsome remarks passed on Captain Webb by the Quarterly Reviewers in return for his his polite communication of some of the heights he had determined. It is quite clear...that no determination of heights will ever satisfy the curious in Europe, that is not accompanied with ample details as to the original observations, as well as a full exposition of the methods of calculations. ... The ordinary routine of surveying is in no way applicable to the determination of so nice a point, which involves many other considerations... [such as] the figure of the earth. ...

By such ample details alone will they be able to judge of the ability of the person who gives them, and it is only when they see that ability fully manifested, that they will place any confidence in the results deduced[12] [48].

[1] ib. 16–11–16 (18). [2] DDn. 136; M 575, 1–2–17. [3] *Govt. Gaz.* 17–4–17; *As R.* XII, 1818 (253–93). [4] Nanda Devi, 25,645 ft.; 30° 22′ 32″ N.; 79° 58′ 22″. [5] DDn. 150 (7). [6] appointed as mineralogist, June 1817 [266]; joined survey 17–2–18. [7] Richard Strachey BCS., writer 1798; Resdt. Lucknow 1815; resd. 1817. [8] Tabriz, Azerbaijan, NW. Persia. [9] DDn. 150 (22), 2–12–17. [10] *Annales de Chimie et de Physique* IX. Paris. [11] No. XXXIV & Vol. 22, 1820. [12] to SG.; DDn. 152 (100), 14–10–19.

In October 1818 Webb sent the Surveyor General another annual report, and a description of the country that will be more fully appreciated if read with a modern layered map ;

Excluding a belt of the turaee (morass and forest), which skirts the base of the mountains on the S.W., the total extent of the survey may be considered as a section of the bank, or buttress, which supports the tableland of Tartary. There is not, I believe, a single square mile of level ground, in one plot, within its boundaries.

The height of the Tuklakot pass, by a geometrical process, appears to be 17,705 feet above the sea, and that of the Neetee pass by the barometer 16,976 feet[1]. These mark the minimum altitude attained by the crest of the glacis. ... The mean distance from the base of the mountains to the plateau of Tartary I consider to average about 95 English miles. ...

The term Himaleea chain, or range, seems to me a misnomer. It is not, as it appears from the plain, a continuous ridge, the dips in which form the passes to Tartary ; nor do the higher peaks approach very near to the tableland [II, 77]. As the traveller approaches the snowy mountains, his road invariably leads along the bed of a river ; as he advances farther, the defile straightens[2], the rocks form perpendicular walls on both sides ; there is scarcely space between them for the stream of the foaming torrent ; ... while avalanches threaten from above, and the current is frequently buried under snow from 40 to 100 feet in thickness.

This portion of his route (perhaps two or three days) is full of peril and difficulty but, when accomplished, the hills again slope more gradually, and he reaches the purgunas inhabited during summer months by our Bhoteea subjects, whose villages are from 10,000 to 12,000 feet above the sea. From these to Tartary the road is generally good, and gradually ascending along the bank of a stream till, on the fourth or fifth day, a sharp ascent of 2,000 or 3,000 feet is encountered, from the summit of which the plateau opens to view. Snow is seldom seen, except sheltered in ravines, during the latter part of the journey. ...

During the current year...the season commenced with survey in the purguna of Chougurkha, passing backwards and forward through it as roads could be found, fixing trigonometrical points occasionally, and completing the course of the Surjoo River. ... In like manner zig-zag lines were measured through the purgunas adjacent. ...

This brought me near to the head of the Gura River[3], which I traced to its debouch at Muswaree Ghat, proceeding thence to Peleebheet, and ultimately to Barelly, to receive a case of barometers recently arrived from England, some of which being found in good order, I marched without loss of time...to Kasheepoor, where it was necessary to make a series of observations, this being the first elevation in the survey, and previously estimated at 650 feet, instead of 757 feet which appears to be the correct value[4].

The observations at Kasheepoor being completed, ... I re-entered the mountains at the Kotdwara Pass [March 1818][5], and repaired to Lungoor Gurh, a lofty delapidated fortress, and the first trigonometrical station in Garhwal. Its position being determined, I traced several routes...settling frequent points of connection. From one of these...I was enabled to connect the triangulation of Kumaon with Hurdwar. ...

As soon as the road to Kedar Nath was reported open, I marched in that direction, crossing the Aluknandra R. near Sireenugur, and occasionally deviating from the road to ascend high ridges where I hoped to establish stations of observations. The latter part of the road led over extensive fields of snow, and the height of Kedar Nath's temple, situated at the base of the snowy peak No III, is 11, 879 feet above Calcutta by correspondent observations with the barometer [II, pl. 9 ; III, pl. 6].

[He returned to Joshimath and, after waiting a few days for a permit, worked up to the Niti Pass][6].

The road followed from Josee Muth to the crest of the Neetee pass was that travelled by Mr. Moorcroft [II, 80], but I should hardly have been able to obtain for the first time a view of the table land of Tartary without exciting the jealousy of the Chinese officers but for the collateral aid I derived from being entrusted with an investment of goods belonging to Government, and destined for the Tartar market.

The barometrical observations on the route are in the highest degree interesting, as they lead to a knowledge of the altitude of the table land, and will possibly...mark a notable epoch in physical science. ...

Upon reviewing the work of the year, I find the results less consistent and satisfactory than in former seasons. They do not, indeed, indicate any great error in the positions of the snowy peaks (all of which were settled from bases to the eastward...), but discrepancies

[1] modern maps, 16,628 ft. [2] narrows. [3] or Sarda. [4] true value about 775. [5] 53 K/9. [6] Fdbk. Oct. to Dec. 1818, MRIO. M 372.

are perceptible. This is in a great measure to be attributed to the want of a better instrument than is in my possession[1].

He was now better able to meet the challenge of the *Quarterly Review*, and at a meeting of the Asiatic Society at Calcutta in February 1819 Dr. Wallich[2] submitted a letter received from him, admitting the justice of some of the reviewer's remarks, such as the want of a measured base, and uncertainty as to the proper correction for refraction, but holding to the general probability of his results.

He has about 20 stations, at very unequal distances from the Himalaya, whose altitudes are deduced geometrically *from* the snowy peaks, and barometrically. The agreements between all of them are very satisfactory[3].

Webb's letter, with his observations at Kedarnath temple and the Niti Pass, was sent to England, and the *Quarterly Review* thereupon withdrew all objections, and declared "absolute confidence" in the results[4] [2].

Towards the end of 1818 he was given the assistance of a draughtsman, Robert Tate, who, besides doing some survey in the field, was specially useful in drawing the maps, which were submitted, some in 1819 and others at the close of the survey[5] [pl. 6]. Webb closed field work in October 1821 and, left India for good in February 1822.

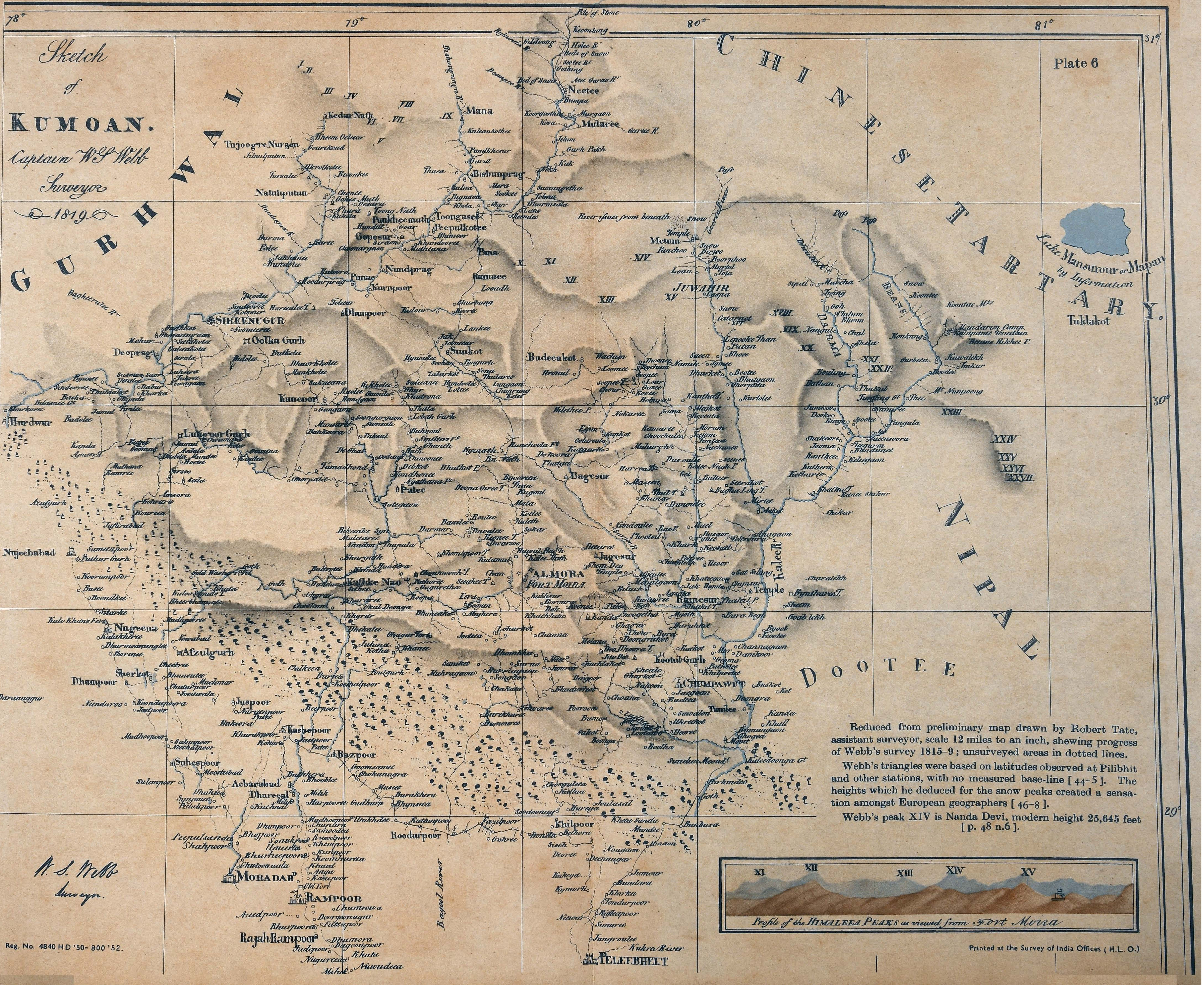
Waugh was not so critical of Webb's work as Everest [45], and does not comment on the lack of a measured base-line. His verdict was similar to that he passed on Hodgson and Herbert [41], viz., that the framework showed considerable scientific skill, and was subsequently adjusted to the Great Trigonometrical Survey, but that the depiction of hill features left much to be desired. He paid a special tribute to Webb when working out the heights of the great peaks ;

I enclose...a memo. regarding the identification of the famous mountain Dewalgiri. Our point XLII is Webb's mountain. ... Any great numerical refinement cannot be expected in comparing our position with Webb's, but the difference...is not so much as to cause any doubt as to the real identity. ... Nevertheless more refinement would be satisfactory, and might be obtainable if Webb's angle books, maps, or reports, are forthcoming in our office, or at the Asiatic Society.

I should like, when I publish, to shew a comparison more accordant, and therefore more worthy of the memory of an old surveyor like Webb, of whose reputation I am the natural guardian[6].

[1] DDn. 150 (53–66), 8–10–18. [2] Nathaniel Wallich (1786–1854) a Dane ; Ben Med. ; Supdt. Botanical Gdns., Sibpur. 1815–50. *DNB*. [3] *As J.* VII. 1819. [4] vol. 22, 1820 (417) ; latest list, *JRGS.*, IV, 1834 (376–418). [5] MRIO. 25 (14), 28 (28–32). [6] DDn. 665 (157), 18–12–55 ; *JASB*. XI, 1842, part 126 (1), pp. xxiv–v, gives list of 50 snow peaks, Webb's No. XIV, ht. 25,669, and Hodgson's No. A 2, being same peak, Nanda Devi [32 n.5, 46 n.4 ; pls. 5, 6].

Plate 6



Reduced from preliminary map drawn by Robert Tate, assistant surveyor, scale 12 miles to an inch, shewing progress of Webb's survey 1815–9; unsurveyed areas in dotted lines.

Webb's triangles were based on latitudes observed at Pilibhit and other stations, with no measured base-line [44–5]. The heights which he deduced for the snow peaks created a sensation amongst European geographers [46–8].

Webb's peak XIV is Nanda Devi, modern height 25,645 feet [p. 48 n.6].

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CHAPTER IV

NORTH-EAST FRONTIER

Gāro Hills, 1817–8 — Sylhet,[1] *1820–9 — Assam Valley, 1824–6 — Source of Brahmaputra, 1825–8 — Manipur, 1824–30.*

SINCE the withdrawal of Welsh's force in 1794 [I, 81–2], the only official contact with Assam had been through petty frontier incidents. It is a favourite pastime of all hill people to swoop down on the rich villages of the plains for profitable loot. In 1816, "after a particularly atrocious raid" on the part of the Gāro tribes, who inhabit the thickly wooded hills at the great bend of the Brahmaputra [I, 19–20], David Scott, Commissioner of Rangpur, visited the frontier and made terms with the tribesmen, who in return for trading facilities were to be protected from exactions by the *zamīndars* along the border[2]. George Wilton [II, 457] was appointed to survey the strip of Rangpur district on the left bank of the river, and such parts of the Gāro Hills as might be accessible[3].

The country was exceedingly unhealthy, and Wilton died after a few months work. Schalch was appointed to carry on, but after four months in the field, he also fell ill, and was sent on a sea voyage to recover [II, 359]. His survey was left unfinished, and the Surveyor General had no map to produce;

> Mr. Schalch's illness had prevented any written notices...except what are contained in his field books. ... When Mr. Schalch went away he expressed an anxious desire to have all the papers of the survey preserved untouched till his return, which I promised, and sealed them up[4]. ... 19 unfinished sketches. ...
>
> To a surveyor it will be understood that the sketches of one is not easily wrought up by another. On this survey an interruption had already taken place by Mr. Wilton's death, whose papers are also deposited here, and if Mr. Schalch cannot resume it I am afraid you will have to commence again anew; this is a necessary consequence of having only one surveyor on an extensive mountainous unhealthy country. It is in fact a never-ending and most heart-breaking undertaking to employ one man in such a situation, and if health is preserved it must take many years, or it will be a very imperfect work[5].

Mackenzie's fears were justified; Schalch did not return to the survey, which was left uncompleted and of little value [18, 329].

SYLHET, 1820–9

In December 1819 Thomas Fisher was appointed to survey the boundary between Sylhet and the independent state of Tripura[6]. He was not able to start till late in 1820 and, as the magistrate could not then attend himself, or arrange for the Tripura representatives, Fisher spent that season surveying the boundary between Sylhet and the independent territories of Jaintia and Cāchār, working from Chāgaon along the banks of the Surma river [pl. 19][7]. He then

> resolved...to...visit Cachar, partly in the hope of enlarging our geographical information in a country so little known to Europeans, but more particularly in the expectation of being able to procure some information relative to Tipperah...to illustrate the ancient boundary between that country and Sylhet.

[1] Sylhet was a Bengal district till 1874 [I, 82]. [2] *NE. Frontier* (29). [3] BGO. 15–12–16. [4] DDn. 154 (129), 15–6–18. [5] ib. (35), 7–9–18. [6] BGO. 17–12–19; *As J.* X. 1820; DDn. 145 (223), Ch. Sec. to Magte., of Sylhet, May 19–11–19. [7] Fdbk. MRIO. M 411, plans 1-inch and 4-inch to mile, MRIO. Misc. 4–O–22.

I have previously consulted...the magistrate of Sylhet on the propriety of my visit, and he was of opinion that, provided the consent of Chowjeet Singh the present ruler of Cachar were obtained, it would be desirable in every point of view, as in addition to the before-mentioned objects I should be able to obtain some account of the passes in the mountains separating the plain country of Cachar from Mekhley Munnipoor, now occupied by the Birmans, who threaten continually to invade the former country, from which there would be no impediment to their entrance to Sylhet[1].

After an adventurous visit to Cāchār [411], he surveyed the Tripura frontier between May 1821 and April 1822, being now granted full responsibility for deciding the line.

The southern part of the district of Sylhet, which borders upon the independent hill territory of the Rajah of Tipperah, having been for some time the scene of frequent disputes arising entirely from the want of a well defined and known boundary, a survey therefore was ordered to be made ; ...

1. To improve the geography of the frontier.
2. To ascertain...the claims of the contending parties on either side of the boundary. ...
3. To obtain a natural and easily recognizable line of frontier, as a river or chain of mountains[2].

Government accepted his line ;

His Lordship in Council trusts that the field book, and depositions stated to have been taken, will contain all the information that can be desired. ... The original depositions as taken by Lieutenant Fisher shall be deposited for eventual reference in the office of the Committee of Records at Sylhet. He will likewise...forward to the Committee...a copy of the field book of the survey.

The greater part of the frontier line is stated to have been laid down with the concurrence of the persons who attended on the part of the Rajah. ... Hence it is presumed that the attestation of these people will have been fixed to the documents and depositions. ... In the meantime...the line of demarcation...should be assumed, and acted upon as forming the actual frontier of the two territories. ...

The line...is sufficiently defined by nullas and by ridges of hills, except...where the boundary line runs over cultivated fields in the valley. Unless therefore some landmarks have been erected, there is danger of its being entirely lost. Lieutenant Fisher's report is not sufficiently particular in defining the precautions taken. ... His Lordship in Council presumes, however, that the requisite arrangements have been made to prevent any future encroachments by the construction of pillars or other land marks. ...

The neatness with which the plan is executed, and the apparent accuracy and care with which it has been constructed, have attracted the favourable notice of Government, while the information collected in the report...is clear, useful, and well digested[3] [pl. 19].

Fisher was now employed on the revenue survey of Sylhet until, on the recommendation of the Surveyor General, he accompanied Scott towards Cāchār where trouble from the Burmese was coming to a head. Scott was now Agent to the Governor General on the North-East Frontier [55].

Captain Fisher's employment was on the Tipperah frontier, south of Sylhet, and on that side his map and information are very satisfactory. ... I believe Mr. Scott has much good local information of the frontier on his side, but the fact is that our operations and attention have been so little drawn to the eastward for ages past, that we have very little of the eastern parts of Bengal [16 n.7].

I certainly should be glad if we had a better notion of the frontiers east of the Burrumpooter, especially the whole boundary of the Sylhet province wherever it touches on any foreign territory, and none can give so good as...Mr. Fisher, if you could borrow his services. ... For the present I think his attention might be directed to the gaining of the best information he can, which might be verified by a survey when the season is more suitable and when there is more leisure, for exact surveys in those countries cannot be rapidly executed on account of the wetness of the country and the insalubrity of the jungles[4].

Scott was directed

to proceed in person to Sylhet with the view of bringing to an early close our negotiations for an alliance with Cachar. ... Your presence in that quarter would be more especially desir-

[1] DDn. 212 (363), 1-5-21. [2] ib. (345, 443), Magte. to Fisher, 1-3-21 ; MRIO. 34 (20-2), part of Sylhet Dist., by Fisher, 1821-2. [3] DDn. 195 (155); BJC. 6-6-22 ; Fdbks. DDn. 230, M 414 ; MRIO. M 412 ; DLR. M 410. [4] DDn. 198 (124), SG. to Pol. Dept. 18-10-23.

able if the Burmese...follow up their designs against that country. In that event it would further conduce materially to the public interests that Captain Fisher accompany you for ...surveying the passes which lead from Munipore and Assam[1].

Shortly afterwards Fisher was required for military duty on the Cāchār frontier, and he writes to the Surveyor General, 27th February 1824, regretting the delay in submitting copies of his memoirs as he was "at present so much engaged having the executive charge of the Quarter Master General's and Commissariat Departments"[2]. In his place, James Blechynden, who had been sent up for the revenue survey [145], was lent to Scott for a pioneer march from Sylhet over the

Khasi Hills from Jynteapore on south to...junction of Kullung and Copley rivers[3], thence down the Kullung to junction with Brahmaputra about 12 miles above Gauhati...thro' a country hitherto unexplored by Europeans[4].

We are to proceed on or about the 30th inst. [March 1824] direct to Joynteah; thence to commence a survey in a northerly direction as correctly as circumstances and the rapidity of the marches would admit of, as far as the Burrampooter River, noticing the face of the country, the difficulties of the road, etc. ... On our reaching the Burrampooter River I was to return by water, as the season would be...too far advanced for me to attempt a passage back over land.

I then called on Lieutenant Fisher, and received instructions from him. ... He would not advise my attempting any accurate measurement of the distance between each day's halting place, but that I should pace those lines which do not pass over steep acclivities, and notice the time employed in each day's march. ...

April 1st 1824. This morning at day break the escort set off; ... I left at 4 P.M. and came up with them...after a march of 6½ hours.

2nd. Marched at 5 A.M. with the escort, and reached Joynteah about 2 P.M.

3rd. Mr. Scott joined us about 2 A.M. this morning. Employed in a trigonometrical calculation to ascertain the height of the range of mountains over which our route would lay; the result was that the highest visible part of the farthest range was 1,300 feet above the level of the country, and that another intervening one was only 1,200 feet. ...

4th. Received orders from Mr. Scott to be very careful in not letting the Cosseahs know what I was about when surveying, and above all not to use the theodolite, chain, or any instrument, as they would get alarmed, and perhaps prevent our passing through their territory, but to use the pocket compass and pace the distances.

In consequence of the difficulty...in procuring coolies, we did not leave our encampment till 3 P.M. ... The first two days marches were the worst of any we experienced; the road was very narrow and almost perpendicular, and for the most part covered with sharp stones on the sides, which so much narrowed it that the elephants with the utmost difficulty...could force themselves between, even after being unloaded. The Company's bullocks could not proceed a quarter of the first day's march owing to the sharp pointed lime stones, which split their hoofs, and were consequently sent back thence.

The distances were paced, the time of each day's march noticed, and the bearings taken with the pocket compass as correctly as the rapidity of the marches and the hours we proceeded...admit of. The paces I calculate at 2½ feet each, but subject to a restriction for the steep ascents and descents[5] [II, 80].

At the close of his military duties Fisher resumed the revenue survey [145], and at the end of 1826 was deputed to survey the boundary between Sylhet and Jaintia, with

the entire duty...of ascertaining the boundary line, and investigating the claims of...the hill chiefs and our own zemindars, where it may be disputed. ...

Commence your survey...from the point at which the lands appertaining to the Rajah of Jaintia to the eastward first come in contact with the northern bank of the River Soormah, and proceed thence regularly to define the line dividing the territories of the Hon'ble Company from those of the Rajah and other hill chiefs, till it again cross the river. ...

At the two extreme points a pillar of masonry should be erected to prevent future encroachment or misapprehension on either side[6].

Two of Fisher's maps were on scale four miles to an inch, and about one degree square. The first had meridian laid down through the circuit house, Sylhet, and was compiled from his boundary surveys of 1821–2 and revenue surveys of 1822–3.

[1] BSC. 28-11-23 (5). [2] DDn. 212 (535). [3] Kalang and Kapili rivers. [4] HMS. 678; *As J.* XIX, (259-61). 1825. [5] Map, 4 m. to an inch, HMS. 678; DDn. 212 (547). [6] DDn. 230, 13-92-26.

It included the roads from Sylhet to Dacca, Cāchār, and Mymensingh, with the branch road along the western foot of the mountains to Pandu, besides various river routes[1].

The second map covered most of the cultivated area of Cāchār, and was prepared from sketches made during 1824–5. It includes the road made by the Pioneers from Badarpur[2] through the Kumranga forest to "Jirimilla", and the mountain route to "Agui", and the course of the Barak river[3].

In 1827 the Surveyor General had to refuse the Quartermaster General's request for Fisher's services on the grounds that he was

employed by...the Territorial Department in Sylhet, in making a very extensive revenue survey under the superintendence of the Collector, and that a number of aumeens are employed under...the Surveyor.

I have...instructed Lieutenant Fisher to avail himself of every opportunity of laying down the various lines of communication, by land and water, of all the principal places in Sylhet, and by means of certain astronomical observations to determine the meridian of the station of Sylhet, that others may be referred to it[4].

In July 1829 Scott submitted

a map of Cossya territory prepared by Lieutenant Fisher. The boundaries of the several districts are merely conjectural, ... but...throughout these mountains peculiar spots are to be found belonging to one chief, although surrounded with the territory of another, and that two or more of them are occasionally found exercising authority in the same village. ...

Few villages have been inserted in this map except such as have been surveyed[5].

ASSAM VALLEY, 1824–6

For several years the Burmese had been pushing west. They had now occupied Manipur and reached Kaliābar and Jorhāt in Upper Assam[6]. In December 1823 they started to invade Cāchār, but were defeated by the British in a clash on the Sylhet frontier [64]. War was declared by the Governor General on 5th March 1824, and on 13th a British force advanced from Goālpāra and occupied Gauhāti. It was at this juncture that Scott marched across the Khāsi Hills [51], reached the Brahmaputra on 15th April, and joined the troops at Gauhāti. The force, about 3,000 strong, now under the command of Colonel Richards[7] [69], advanced as far as Kaliābar without much opposition, but had to withdraw during the rains, when the Burmese again advanced as far as Nowgong, looting and plundering.

At the close of the rains, the British went up the river by boat, reached Jorhāt 17th January 1825, and occupied the capital, Rangpur near Sibsāgar, on the 30th. The Burmese hastily evacuated the country, taking off about 30,000 Assamese as slaves[8].

Before the start of the expedition the Surveyor General had been asked for

copies of the best maps extant of Assam and...the Burrumpooter (supposed to be...Wood's... survey in 1793) [I, 80–2] as also of the Garrow frontier generally. A copy is likewise required...of the best map of Sylhet, and as much of Cachar as may be known from survey or report. These sketches, being for temporary use, may...be hastily taken on oiled paper, and will be held liable to return or transfer on the completion of the service. ...

You will take measures for the attainment of as much geographical knowledge on or beyond...the eastern frontier as the present or expected movements may admit ; your assistant Captain Cheap being with the force to the south east [67], Lieutenant Fisher of the Quartermaster General's department in Sylhet [51] and some competent officer perhaps available with the north-east detachment at Goalparah[9].

No surveyor was available until the arrival of the revenue surveyors from the Upper Provinces [151] when James Bedford was given charge in the Assam valley, being ordered on 20th December 1824

[1] See also MRIO. 36 (23), 16 m. to one inch. [2] 83 D/9, 15 m. W. of Silchar. [3] DLR. Fdbk. 70; ½-inch map S. Cāchār, MRIO. 34 (5). [4] BTC. 22-3-27 (12). [5] DDn. 262 (15), 26-7-29. [6] Bhuyan (459-75). [7] Sir Wm. Richards (1778-1861); Ben. Inf.; Gen. 1854; Hodson III (641-2). [8] *Imp Gaz. Assam* and *Frontier Expeditions*, V (10, 39). [9] DDn. 205 (28); BMC. 16-2-24.

to make every practicable expedition to proceed to Assam. Lieut. Wilcox will accompany you as your assistant, and Mr. Polhill will be attached to your survey. ...

A minute and accurate survey of the country through which the army may penetrate is entrusted to you. The ignorance which at present prevails...renders...a correct local knowledge of it of peculiar interest & consequence. ... Leave no opportunity untried of pushing to the utmost your enquiries and researches[1].

Besides these written instructions,

Bedford was verbally directed to consider the Brahmaputra as his chief object. He was to endeavour to unravel the mystery...respecting its fountain head, by proceeding up its streams as far as...the safeguard of a detached escort might permit[2].

The revenue surveyors were at first under Schalch's professional orders, but were later placed under the Surveyor General[3] [333]. There were several other surveyors with the troops, some under Bedford's orders, and some working independently as opportunity arose[4]. Burlton, Jones, and Neufville were on the Q.M.G.'s staff, whilst Mathew and Bedingfield worked for Scott[5]. In April 1825 Scott sent in

a map prepared by Lt. Burlton, exhibiting the upper part of...the Brahmaputra, or Loheet, as far as it is navigable[6]. ... Lt. Burlton's means did not permit of his following the course of the river to the Burmah Koond[7] [I, 78 n.5], but the diminished volume of water, and the unbroken appearance of the mountains, together with the information gathered from the inhabitants of Sadiya and that neighbourhood, all tend to a belief that it cannot come from the very distant point assigned to its source by modern geography.

The Dehong, which Lt. Burlton could not examine...for want of provisions, was considered by him, but not ascertained by measurement, to contain a larger body of water than the Luheet and, from its size and direction, it would appear most probably that this branch is the continuation of the Sanpo[8], if either of them are so. ...

These points will no doubt be satisfactorily settled by Captain Bedford and Lt. Wilcox in the course of the ensuing year.

Scott pointed out that the discharge of the Brahmaputra greatly exceeded that of the Ganges, far more so than estimated by Rennell [I, 78–9] ; he quoted measurements made near Goālpāra by Bedingfield in December 1823, and by Burlton in the middle of March 1825[9].

Calcutta papers were full of correspondence about the Brahmaputra, an article in the *Government Gazette* of 9th May inclining to D' Anville's belief that the Tsangpo flowed out through the Irrawaddy [57]. The *Gazette* of 20th June produced a "lithographic sketch of the upper part of the Brahmaputra...from a map prepared by Lieutenants Burlton and Neufville on the spot". This takes the upper Luhit to about ten miles above Sadiya, and shows the Bori Dihing and Noa Dihing in considerable detail[10] [pl. 7].

Wilcox gives the following account of the surveys of 1825[11] ;

We arrived at Goalpara...in the latter end of January 1825, immediately after the capitulation of the Burmese at Rangpur ; and we were then eager to join the headquarters, in full expectation of an attempt being made to advance towards Amarapura. ...

Ensign...Wood's survey reached no further than Rangpur, and he leaves the space beyond a perfect blank [I, 81]. ...

Lieut. Burlton was detached to survey the river beyond as far as possible. ... The natives knew well that the boats of Bengal could not pass more than one day's journey beyond Sadiya ; they spoke confidently of the Bramakund, the origin of the river, being situated in the east and, indeed, they had presented a map drawn in their own incorrect style. ... It was afterwards remarked that in this production the Dibong and the Dihang were not distinguished from other tributary streams.

The commission with which Lieut. Burlton was charged was executed by him in a highly creditable manner. With a surveying compass only, and unfurnished with any instrument for measuring distances, he surveyed the river to Sadiya and a short distance beyond, and subsequent survey has detected but little error in his map.

[1] Orders by Schalch ; DDn. 214. [2] Narrative by Wilcox, *As R.* XVII (315). [3] BGO. 29–7–25. [4] Maps received from QMG. July 1824, MRIO. 171 (18, 19). [5] Maps., ib. 37 (11–2, 19–20). [6] ib. 171 (27). [7] Brahmakund, 92 A/5. [8] Proved correct by Bailey & Morshead in 1912. [9] DDn. 230, M 414, 20–4–25. [10] See also HMS. 678. [11] *As R.* XVII (314–469).

Burlton reported that he imagined the source of the Brahmaputra must lie in some high mountains, covered with snow, which he saw away to the east, beyond the direction of the Brahmakund, which he told me was a large bottomless bay at the foot of a perpendicular height over which the river falls. He also gathers that the Irrawaddy rises in the same range.

In the meantime Bedford and I had reached Bishnauth[1], and received orders to survey the Buri Lohit, or old channel of the river, ... one of us re-surveying...the Dihing or southern branch. Captain Bedford chose the Buri Lohit as it represented novelty, and left me to re-trace Ensign Wood's steps towards Rangpur. He completed his survey, but I met with an unfortunate accident; ... about half way from Bishnaut my map and field book, with the greatest part of my property, were lost by the sinking of my boat.

Captain Bedford afterwards continued his route towards Sadiya, making a more accurate survey than Lt. Burlton had the means of doing, and before the expiration of the month of June he had surveyed not only...the great river from Bishnauth to Tengapani but, having accompanied Capt. Neufville on the expedition against the Singfo[2] chiefs, he also added a hasty survey of the Noa Dihing[3].

Wilcox himself continued with the troops, making hasty surveys up the Disang, down the Buri Dihing, and up the Dikho, though much hampered by the loss of his best instruments, which the Surveyor General could not replace till the close of the Arakan campaign. Jones made route surveys with detachments sent out from Rangpur, and sketches of other branches of the great river[4]. Neufville and Bedingfield collected information from Burmese prisoners and others about the country in the direction of Burma, submitting a map which included the Chindwin River. Mathew surveyed the Dhansiri River[5].

Bedford reported monthly to the Surveyor General;

29th August 1825. The whole of my field work is now protracted, and my calculations for latitude, time, and longitude, in hand. ... In the absence of any particular instructions, ... I propose...to explore as far as may be practicable, even in a canoe, the Lahree Diping and Dihing rivers, which have excited of late a good deal of local interest; and on...to lay down such part of the northern bank of the Burhampooter and neighbouring islands I was not able to survey last season. ...

16th September. ... I was induced, from the low state of the river, to undertake a short survey...to connect the Munjoluh point with the Dikhao Mookh, where the Disung Nuddee also joins the Burhampooter, and Lieut. Wilcox's surveys now form a connected map with my own operations on the main river. ...

As the Singphoh Chiefs now appear amicably inclined, I propose, after examining the Dipung and Dihong rivers, to proceed again towards Sudeea, with a view to establish... Beesagaum and the Kusan pass, which the want of instruments prevented when I accompanied Lieut. Neufville's detachment. ...

11th October. ... I have recently received instructions to detach Lieut. Wilcox for... accompanying the troops...and to continue my own operations on the river. This double arrangement...renders the want of many useful instruments the more to be regretted. ... Lieut. Wilcox has neither a telescope, barometer, or chronometer, nor are the results of his sextant so much to be depended on...from the want of a false horizon glass since the loss of his boat. ...

I quitted Rungpur yesterday afternoon. ... I purpose successively to attempt each of the streams which join the Burhampooter...a little below the Koondil Nuddee on which the town of Suddeea is situated, and afterwards to proceed to that place with a view of exploring the upper parts of the Burhampooter, in which I might probably have the company and assistance of Lieut. Bedingfield[6]. ...

28th November. Anxious to avail myself of the short leisure which the slow progress of the Assam Field Force up the river allowed, I halted but one day...to lay in ten days provisions, and again started on the 18th inst. to explore the Dihung River.

Though a good deal annoyed and delayed by the occasional rapids...I succeeded on the 5th day in making my way to an Abor village called Puseeal, situated on a small hill of the first range; but, ... although the water would have admitted my further progress, all my endeavours to persuade this mountain tribe to permit my further progress proved unavailing. In fact they appear of late to have been so closely watching our operations in Upper Assam, that even my appearance caused no small suspicion, and I was received by the villagers in

[1] 83 F/2. [2] or Kachin, a tribe of Upper Assam and Burma. [3] Maps, MRIO. 37 (26–7); Misc. 6-0-26. [4] Fdbks. DLR. 404–5. [5] *As R.* XVII, DDn. 230, 7-6-25; MRIO. 36 (20-2) 183 (26, 28). [6] DDn. 214.

arms. ... After the first day I partly succeeded in allaying their suspicions, and ultimately found them civil and even hospitable. I could not, however, overcome their disclination to my further progress. ...

I expressed my wish to return, but could not effect even this until the afternoon of the 24th when, after exchanging presents, we parted on friendly terms. My detention, though unpleasant at the time, enabled me to collect some local information. ... They all agreed that two more days would have brought me to where the main river issues from the hills ; in fact, when their first suspicions were allayed (and with two seapoys only there was but little to cause any...), I found them very communicative. ...

As the Assam Force is still in my rear...I propose to take 15 days provisions on my canoes and proceed up the Depung[1] river. ... With regard to my present operations (which have hitherto been carried on by regular measurements and intersection ; ... I can in general keep pace with the canoes up these stony streams), ... no application for any escort beyond the naick & four men has been made, from a conviction that, amongst these warlike mountaineers, any force which my canoes could accommodate would be perfectly useless in case of attack, and merely excite their suspicions, so that whatever is effected...must be by persuasion and conciliatory conduct.

He adds that Wilcox had recently been ordered down to Goālpāra [56], and had "since applied...for a few smart lascars to instruct others who may be entertained to accompany him towards Thibet", Bedford having brought several of his revenue survey lascars from Morādābād[2].

Bedford's journey up the Dibang was just as disappointing as that up the Dihāng ;

I yesterday returned to my budjrow after an attempt to trace the Dipung River to its source. Notwithstanding the strength of the current, and the great number of rapids... I arrived near the Mismee villages situated on the small hills...of the nearest northern range.

Here, I regret to say, the prejudices and fears of the inhabitants again foiled me. ... My disappointment...proved the more mortifying from having, after some days discussion and exchange of presents, gained the consent of the three Gaums...to my further progress ; hardly, however, had my boats been unmoored on the following morning when other headmen arrived, and objections were raised. ... After a vain wait I ordered my boats to be unmoored for...moving down the river.

To this no interruption was offered by the Mismees, but...one of my double dingees was broken to pieces in a rapid, ... where the water was so strong and deep that no attempt could be made by those on board except to save their lives, and every thing, except one or two articles washed on shore about a mile lower down, was lost, including the arms and accoutrements of two seapoys, my personal supplies of every kind, and table furniture. Fortunately five days supply of grain...was on board another dingee when the accident happened[3].

Still undaunted, he

turned up the Dikrong above Kamjan, and the voyage continued three days till the river became too shallow for the canoes to proceed, and Capt. Bedford returned to the Dibong, and got back to its mouth on the Brahmaputra on December 26th, after 6 weeks in unknown waters[4].

He then turned to the exploration of the rivers beyond Sadiya, and in April 1826 reported his return "from a most harassing survey up the Sokato, a branch of the main river, which terminated in a visit to the Burhma Koond"[5]. He took sections of the Dihāng, Dibang, and Lali rivers at three different seasons, and of the Bara Luhit, Naya Dihing, and Tenga rivers at the commencement of the rains. He reported back in Calcutta on 6th September 1826[6], leaving Wilcox and others to carry on the good work.

SOURCE OF BRAHMAPUTRA, 1825–8

Both Blacker, Surveyor General, and Scott, in political charge of Assam, were anxious to solve the riddle of the Brahmaputra, and in September 1825 Blacker asked for Wilcox to be put on special duty to trace "the sources of the

[1] Dibang. [2] DDn. 214, 28–11–25. [3] ib., 27–12–25. [4] *As R.* XVII (331). [5] DDn. 214, 14–4–26.
[6] Journals, *IO Cat.* (118); DLR. M 452–3 ; submitted map of all his Assam surveys, DDn. 214, 22–12–26.

great body of water which the Brahmpootur pours through Bengal"[1] [I]. Scott concurred, and on receipt of Government approval Blacker sent suitable instructions to Wilcox, adding that

abundant information, if of ordinary accuracy, will be of more consequence than a very limited quantity that may possess higher pretensions to mathematical correctness. ... You will attend particularly to the wishes and views which Mr. Scott may...communicate to you[2].

Wilcox replied from Goālpāra ;

26th October. ... I am prepared to start tomorrow morning, having arranged with Mr. Scott for every assistance. ... Mr. Scott has recommended that my first attempt shall be made on...the Sooburnu Shree[3], falling into the Boree Lohit in longitude 94° 13′, considering that if, as reported, this river have a navigable course of 8 or 10 days journey in a N. and S. direction, a successful trip up it must tend to throw light on the connexion of the great Thibet river with the waters of the plains of Assam[4].

On the sixth day of his journey up this river, finding the rapids "dangerous for canoes of the smallest size"[5], he abandoned further attempt in this direction and moved up to Sadiya, where

Capt. Bedford had already proceeded up both the Dihong and the Dibong as far as he was permitted by the mountaineers, and I had great reasons to fear that the same obtacles...would also interfere with my progress, but with a supply of presents and a guard I did not hesitate to make the trial[6].

Accompanied by Burlton he was, however, held up on the Dihāng by the same villagers as had stopped Bedford, and he then tried the Mishmi hills to the east. He writes from Sadiya,

25th February 1826. ... This month I have been occupied in a trip to the Mishmee Hills east of this place & a short distance south of the river. ... When I set out the commissariat was unable to add one day's provisions to my own stores, &...I was...soon compelled to return.

The distances in my field book were all estimated in time. ... It would be an object to proceed in this hasty manner [without] any attempt to use measuring instruments, since these are calculated to increase the difficulty where jealousy already exists.

Had not Captain Bedford expressed his earnest wish to be the first to explore the upper parts of the Burrumpooter, I should have adhered to its course. ... I now propose to retrace my steps to the hills, & thence endeavour either to reach the Lama country N.E., or the Bor Kampti country S. of E[7].

5th May. ... I proceeded early in the month of March to the Meesmee Hills directly E. of this place, & had the route been practicable at the time should have journeyed on to the Bor Khampti country, situated on both banks of the Irawady ; but I found that the heavy snows still covering the range which must be crossed would yet delay me at least another month &, having ascertained that the only road to Thibet known to the mountaineers lies very near the course of the Burrumpooter, in deference to Capt. Bedford's wishes before alluded to, I refrained from pursuing that direction. ...

Mr. Scott proposes that I shall proceed once more up the Deehong & endeavour to mollify the Bor Abors with a view...of our being able to march up the bed of this river in the cold season. From hence [Sadiya], the opening whence it issues is distinctly seen, ... 50 miles in N. Wly. direction, & the hills filling up the back-ground are low ; the break in the range is more marked than that I have seen in any other river, & the only objection to the palpable supposition of this being the Lhasa river is the singular account in Assamese history of the sudden increase of the Deehang from a trifling stream to a mighty and over-whelming river, which...swept before it many villages. The date of this occurrence is A.D. 1735.

2nd September. ... On the 29th of March I took...a section of the Burrumpooter opposite the station of Sudeeya, which gave the discharge 33,900 feet per second, but the following day I took with equal care a section...below the junction [with the Dihang] ; ... the result was a discharge of 120,000 feet per second ; deducting the value of the Burrumpootur & 12,000 feet assumed as the outside discharge of the Deebong, we have 74,300 feet per second for...the large branch[8].

1st June. ... In the early part of last month I proceeded to the Deehang river, & brought down to Mr. Scott the Abor chieftain who formerly objected to Captain Bedford's and to

[1] DDn. 204 (208), 27–9–25. [2] DDn. 220 (109), 15–10–25. [3] Subansiri, 82 L, 83 I. [4] DDn. 214, 26–10–25. [5] Map ; MRIO. 173 (30) ; Report, *As R.* XVIII (326) ; DLR. M 451 ; DDn. 214, 20–12–25. In ignorance of this, Godwin-Austen, in 1867, was directed to explore the Subansiri as a possible source of the Brahmaputra. [6] *As R.* XVII (331). [7] Mishmi Hills, 92, A.E. ; Hkamti Long, or Putao, hdqrs. later Fort Hertz, 92 E. [8] cf. note on map MRIO. 173 (20–2).

my passage, &...the result of their visit is a fair prospect of getting their full consent & assistance...as far as their country & influence extend. ...

Intelligent Bootea merchants, one particularly who had travelled from Lhasa into China, gave Mr. Scott...a sketch of the Sampoo, in which they lost it at a point very far east, but affirm that it flows southwards through the Abor country, and is known to us as the Burrumpootur. ...

I have lately been occupied in a survey of the Tenga Panee, which I ascended till its breadth was reduced to 8 or 10 yards, & canoes could not proceed no further[1].

The Luhit valley and all its tributaries within reach of Sadiya had now been thoroughly explored as far as accessible. Several routes had also been brought in by native agents employed by Scott, one of whom had visited the Moamaria country[2] "to ascertain the extent of cultivation"; his route, was protracted taking "1,320 of his double paces as equal to one mile" [II, 80]. Wilcox spent much of his time during the rains studying the language and collecting information about the country to the east towards the sources of the Irrawaddy. He sent the Surveyor General "a sketch of the route to Hookong[3]...compiled from numerous sketches given me by Sinpohs and others, and from verbal information carefully compared"[4].

The work of the past year had shown conclusively that the Luhit branch of the Brahmaputra that came from the Brahmakund was not the main river, but that the great volume of water came down the Dihāng. This was, of course, no proof that the Dihāng was the outlet of the Tsangpo, and Wilcox's next task was to test the widely held theory that the river of Tibet discharged its waters through the Irrawaddy [3, 54]. Hodgson, who was now Surveyor General, wrote to him;

A great interest is taken about the Burrampooter and much nonsense issues from the press. ... Mr. Klaproth,[5] a continental coxcomb, has written that the Sampoo is the Irawuddi, which can hardly be. Sampoo means a river, but the Guroo Sampoo of Du Halde [I, 70 n.9, 79] issues, it is supposed, from the high land near the Mansarovur Lake [I, 72; pl. 7; III, pl. 6]; I say 'suppose', for I have no evidence to that purpose, but think it likely to be the case. If so, its length...to the north-east of Ava would make it a very large river. Rennell thought it was the Burrampooter [I, 79, pl. 14] but, supposing it to come from so far west as the Munsarovar Lake, it would even then be almost too large a stream to be one of the main feeders of the river. ...

Pray make all enquiries respecting rivers flowing on the north of the snowy chain, from west to east, or otherwise. Turner, in his Embassy to Teshoo Sumboo [I, 74, 394], saw a river he calls the Burrampooter or Erechoomboo...which he says goes into Assam [I, 80][6].

The following review explains Klaproth's theory;

Mr. Klaproth of Paris has had a map of the part of Asia that lies between 21° and 31° N. and 89° and 101° E. engraved for the second number of his Magazine Asiatique[7]. ...

What makes this map and the memoir...particularly interesting at this present time is that it lays down the sources and course of the river Brahmaputra, about which there has lately been much speculation; and that it gives the course of the Yarudzangbo-tchu, or river of Tibet, which Rennell has erroneously connected with the Brahmaputra [I, pl. 14].

The courses of these rivers as laid down by M. Klaproth afford strong confirmation of the opinion...read before the Royal Asiatic Society about 18 months since, namely "that the Sanpoo, or river of Tibet, is not connected with the Brahmaputra, but is probably connected with the Irrawady, or river of Ava"[8].

Hodgson also called attention to an article by Wilford *On the Ancient Geography of India*[9], which gives a summary of Hindu legends concerning the rivers of upper India [I, 397];

I think, as far as it goes, the notice in the Ancient Geography agrees with the information you have sent down. There is one contradiction, however, in the ancient story. He calls the east branch the Lohita, which it is, and mentions how it became so by the stroke of the weapon of Brahma Koond, and in another place it says the Lohita joins the Burhampooter

[1] ib. 171 (16, 17), 173 (31); DDn. 214. [2] on left bank of Brahmaputra, N. of Burhi Dihing R.; Moamarias, formerly turbulent religious fanatics [I, 399]. [3] Hukawng valley, 92 B. [4] DDn. 214, 6-10-26. [5] Heinrich Julius von Klaproth (1783-1835), orientalist & traveller, son of Martin Heinrich Klaproth (1743-1817) foremost chemist in Germany; *As J.* XIX. 1836 (65-71). [6] DDn. 220 (176), 17-11-26. [7] Review of Arrowsmith's map of 1822. Klaproth, Paris, 1826, *IO Tract.* 457; *Memoires relatifs à l'Asie.* 3 vols. Paris 1824-8. [8] *As J.* May 1826 (621). [9] *JASB.* 1851.

from the north, coming from Tibet. This looks more like the Dihung. The enquiry is highly interesting, and I hope you will be able to throw great light on it[1].

On the 8th October Wilcox started on an unsuccessful attempt to trace the source of the Luhit to the east of the Brahmakund [pl. 7];

I kept the road along the south bank of the Burrumpooter & had arrived opposite the village Soomlit; this village, I suspect, will have to be carried more E., while the latitude is not much in error. ...

The path, which scarcely ever deserves the name, is such that I question whether in circumstances of leisure any actual measurement by chain or line could be made. Whilst winding in the dark cover of a thick tree jungle, the direction of the path changing every 20 or 30 yards, I have sometimes had no better means of estimating my direction than...the sun's light or, on issuing forth from it, a bearing on a peak before observed. ... A large portion of my route may be corrected by bearings on such peaks. ...

Owing too to the badness of the path and the scarceness of provisions, many articles of utility in surveying, or necessary to private comfort, must be left behind. It is absolutely requisite that not a single extra man should be taken; every one, either sepoy or coolie, carries his own food & cooking utensils &...some article of mine of small bulk.

I took...my large sextant, but no roof for my false horizon. My only barometer tube & two thermometers were broken before doing me any service. I had no Hindoostanee, ... the only servant I originally took having been early knocked up. Khamtees such as I had, or men or similar habits, are the only people who could act as an escort or as coolies[2].

He regretted that Burlton was not of the party,

for, with one staunch friend who knew how to use a double-barelled gun, I should have been very ill inclined to suffer myself to be bullied by the barbarian *Mishmis*.

With "a stock of twelve days provisions" the party broke new ground beyond the Brahmakund, and

such was the nature of our slippery and rugged path that although we passed the holy pool about nine o'clock it was twelve when we arrived at the mouth of the *Mtee* rivulet, about one thousand yards beyond it. A little *Mishmi* boy led the way, clambering up the face of a perpendicular rock, assisted by a hanging cane made fast for the convenience of passengers to some trees above. All that I could surmise of our direction was that we were travelling towards the east...and owing to the sharpness of the ascent the distance was equally uncertain.

They were held up by rain for three days a few miles beyond, taking shelter in a Mishmi "hovel", vacant "on account of two or three deaths". Then, working north, they dropped down to the main river, here named Tellu on modern maps, and for the next two days

continued along the left bank of the river to the mouth of the *Lung*[3], where we found *Ghalūm*, who had parted from us six days before to have a bridge built [across the Lung]. ... While at *Ghalūm's* village I had three good observations for latitude...which gave 27° 50′ 33″·2. Of the direction...I could now be quite sure, as I not only had bearings...on *Ghalūm's* house, but could now recognize a low peak very near our [last] halting place. ... We had been employed the entire day in advancing less than two miles.

They were kept waiting at *Ghalūm's* village four days whilst the Mishmis feasted on a *mithan* [ox] slain in their honour, and wrangled over presents and the possibility of further advance. On 31st, "after an awkward diminuation of my stock of provisions", they moved on to the next village where they were glad to barter a few seers of salt for six days supplies. They then followed eastward up the Luri River, crossed the high ridge which rises to over 10,000 feet, and compels a northward bŭlge of the Bramaputra or Tellu, and dropped down into the village of Ruding, a Mizhu Mishmi chief. Here on the banks of the river they lost two more days.

I was very anxious to proceed the next morning, but was foiled again by the lazy Mishmis; they wished to wait for the return of our emissaries, or at least to allow them one whole day for a parley with the chiefs. With rice to eat, and a house to sleep in, they could not conceive that any motive need occasion haste. In the course of the day we learned that we are threatened by one chief, who declares that if we come near his passes he will roll down stones on us.

[1] DDn. 223 (42), 30-11-26. [2] DDn. 214, 4-12-26. [3] Lang R. 92 A/5.

In spite of this warning, Wilcox made two more marches up the left bank of the river towards Jingsha's village[1] [pl. 7], before he was again held up by ominous threats, and at the earnest entreaties of his followers made a discreet withdrawal just before midnight. The next day they were told by Ruding's son

that an hour or two before daylight in the morning the assembled warriors had invested our position, and concealing themselves in the jungle while advancing from all sides they at last rushed upon our huts, and to their infinite disappointment found them empty. I do not vouch for the truth of this story, ... for I found that Ruding's game was now to demand a reward for his interference to preserve our party from utter destruction.

Wilcox's furthest point lay some thirty miles east of Brahmakund[2], though he had travelled quite double that distance. Up to the last day before his retreat he had been fixing his positions by the sun at noon, and bearings to recognized peaks. On the return march he followed the main river right back to Sadiya[3], and wrote to the Surveyor General on 4th December;

I hasten to report to you my return from a laborious and unsuccessful journey. ... Having penetrated into the Meezhao Meeseemee country, which is entirely beyond the sphere of our influence—... strongly suspecting that the presents I had dealt out had so excited the cupidity of some chiefs that they meditated an attempt to plunder me—I yielded to the wishes of my people and made a hasty retreat. ...

As I feel confident that their thirst for plunder may be restrained by my appearing amongst them with a more respectable escort, I propose to make another trial, ... in which I shall have the great advantage of Lieut. Burlton, who has been appointed to accompany me.

The upper Luhit basin above Brahmakund was not properly surveyed till visited by the Mishmi Mission survey detachment of 1911–2[4].

Wilcox now received an invitation from the Abors to pay them another visit;

Having had some experience, however, of their uncouth manners, and of their susceptibility of being suddenly influenced by the strange harangues of their native orators, I requested to have with me a small party of regular troops who might keep the villagers in some awe. ... I had also 15 musketeers of the Khamptis to accompany us if we should be able to advance.

With Burlton with me I arrived at Singaru Ghat, and sent the Mishmi chief, resident of the Dihong, to the Membu village[5] to remind them of their invitation, and received satisfactory replies. ... After a conference the Membu people promised to inform the Bor Abors of our arrival. They declare the Dihong to come from a very great distance, and that it can nowhere be crossed but by boats or rafts, being always too wide for a cane bridge.

They were allowed to visit Pāsi village[6], where "the breadth of the river was reduced...to 100 yards, and it was still mild and tranquil, but the form of the hills suggests immense depth". They then returned to "Shingaru Ghat"[7] till some Bor Abors came down and promised to get the orders of their chiefs, after which Wilcox returned to Sadiya still further convinced of the identity of the Dihāng with the Tsangpo[8];

19th January 1827. We visited two of the nearer villages without meeting any decided opposition. We explored the river about two days journey beyond the point reached by Capt. Bedford [54–5]. ... We were suddenly brought up by the nature of the bank which no longer shelved to the water from the bases of the hills, but presented perpendicular rocks, surmounted by very steep hills, which are covered with a jungle too dense to allow of cutting a path. We proceeded 2 or 3 miles further in a small canoe, but were stopped by a rapid, formidable to ascend & promising destruction to the boat on return. Scrambling over the rocks, I saw another long reach of still water above, & this, as well as the part we had explored, is in a westerly direction. ...

All my accounts agree in placing the source of the Deehong at a very great distance, that is, far beyond the ken of my informers. The Simongs, a hostile tribe, were close at hand, & I have reason to conclude that the Lamas are beyond them at no great distance.

1st April. ... I do not think that I conveyed a sufficiently strong impression of the hostility of the Abors to our attempt to enter their country. When...50 or 60 of them suddenly intruded on us one evening, they no doubt *intended* to oppose our further progress, and I got rid of them by promising that, without permission, I would not leave the banks of the river for the

[1] *v.* map facing p. 314, *As R.* XVII, 1832; cf. MRIO. 157 (45); pl. 7. [2] short of Kuimbum, 92 A/9 [3] *As R.* XVII, 1832 (362–94). [4] *SI. Records* IV (14–6). [5] 8 m. NE. of Pāsighāt. [6] Pāsighāt, 82 P/8 [7] Sigar, 4 m. below Pāsighāt. [8] *As R.* XVII (395).

path inland. Their insolence to us at Memboo, while their guests, was so great that we heartily congratulated ourselves when we had cleared the village without further disturbance[1].

He was at last able to start on the long-planned trip to Hkamti Long. He left Sadiya with Burlton on 15th April, reached the Irrawaddy near Putao, or Fort Hertz, and got back to Sadiya on 16th June, saturated with malaria.

I am prepared for starting, & am much annoyed at the unnecessary delay caused by the nonchalance of a Singpho of rank [54 n.2] whose arrival I expect. He is to accompany me.

I shall carry my barometer & hope to set it up in the snows ; also my sextant in which, with all its error, I feel more confidence than in the circle. The perambulator too *if possible* I will wheel ; I fear it will not stand the shock of traversing the stones [69][2].

To quote from his official narrative[3] ;

I...looked with anxiety at the snow on the mountains, waiting till...they might be pronounced practicable. I had left it to the Luri Gohain to make such arrangements as appeared to him necessary, ... and he, considering it only proper to have with us some Singfo chiefs of responsibility, ... fixed on the son of the Gam of Latora, and a relation of the same family. ... These two with their following were to add about fourteen to our number ; some Khamtis of rank from Sadiya with their followers number as many more, and for a guard we had ten of the Khamti militia. We had but 16 coolies to carry our ...own light equipment of necessaries, several bundles of presents, besides...instruments.

We embarked our stock of rice and our own followers on the 15th April. The navigation of the Dihing[4], which we entered on the second day, proved very tedious.

They left their boats at Kusan[5] and started into the hills keeping the Dihing on their right [pl. 7] ;

We were now to...enter a wild region where no paths exist but those made by the constant passage of wild animals. ... For the last two years none had traversed the wilderness excepting the two Mishmis who were now our guides, and their only means of finding their way... was to hunt for the notches left on the trees by themselves, and by occasional travellers of old before them.

The elephant was sent back as no longer useful. The perambulator has been left at the Dapha with the Burman who wheeled it, who had already fallen ill. I had offered in vain a handsome reward to anyone who would undertake to convey it on, and afterwards found it could not possibly have been used [69, 220].

On the 4th May we left the Dihing. ... The men lent us from the Tumong Tikrang now took their leave. We could not induce them by any offer to proceed further into the hills. Two of Lieut. Burlton's men were attacked with fever, and we anxiously endeavoured to persuade them to leave us and return to Sadiya, but they would not. They were probably afraid of being seized as slaves by the Singfos.

6th May. We were now crossing that ridge of mountains which separates the nearly parallel streams of the Dihing and Dapha[6]. ... Beyond the Dapha, at no great distance on the north, a high wall of mountains capped with snow stretched eastward to some distance[7], and then turning south, gave rise to the Dapha and Dihing on this side, and to several rivers flowing into the Irawadi on the other.

Burlton now developed fever, and they had much rain. They crossed the Hpungan Pass, 10,080 feet, and then the Namchai stream which, like the Hpungan stream, flows into the Nam Lang, about twenty miles west of Fort Hertz.

On the 20th it continued to rain heavily but, as this was to be the last day's journey eastwards, ... we set out. After wading through the Kumtong, we shortly began the ascent of the hills separating the Namlang river from the plains of the Irawadi[8]. ... We at last, about two o'clock, beheld at a distance the object of our deepest interest, the Irawadi, winding in a large plain, spotted with light green patches of cultivation and low jungle. Better eyes than mine could distinguish Manchi, the capital[9]. ... We were met at last by the Rajah's son with two ponies for our use, and our approach towards the villages was noised by incessant beating on two little gongs[10].

I was lame from an unpleasant sore in the foot contracted on the march, and Burlton was not at all in order for moving about.

[1] DDn. 214. [2] ib., Sadiya, April 1827. [3] *As R.* XVII (412–53) ; DDn. 226, M 479. [4] Noa Dihing joins Luhit 10 m. E. of Sadiya. [5] possibly near the present Khamuk, or Khagan, 92 A/2. [6] Dapha joins Dihing 28° 30′ N., 96° 30′ E. [7] part of Namnenglong Madin Range, with peaks up to 14,376 ft. ; 92 E-2. [8] The W. branch, here called Nam Kiu, or Mail Hka. [9] Man Se, 5 m. NW. of Fort Hertz. [10] A typical Shan welcome to this day.

We were anxious to make arrangements for a visit to the Irawadi, which we could not well contrive at Manche on account of the enemy's stronghold, Mong Khamti[1], being in the way. ... When, however, they found us fixed to have a sight of the Irrawadi, and to avoid fighting where we had no quarrel, they consented to furnish ponies and a guide, that we might see the river higher up, at a point sufficiently removed from danger. ...

In the morning we went off at an early hour, accompanied by a guide mounted on a third horse, and in two hours we crossed the plains. The Irawadi, we were surprised to find but a small river, smaller than we anticipated, though aware of its sources. It was not more than eighty yards broad, and still fordable[2].

As to the origin of the Irawadi, I felt perfectly satisfied from the moment I made enquiries at Sadiya but, since further evidence founded on the reports of natives might not have satisfied those who had adopted Mr. Klaproth's opinion, ... I had resolved, if possible, to have ocular and incontrovertible demonstration ; and I could not help exulting, when standing on the edge of the clear stream, at the successful result of our toils and fatigues.

Before us to the north rose a towering wall, stretching from W. to E., offering an awkward impediment to the passage of a river[3], ... and we agreed on the spot that, if Mr. Klaproth proved determined to make his Sampo pass by Ava, he must find a river for his purpose considerably removed towards, or into, China.

Wilcox observed the latitude of Man Se to be 27° 29′ 16″·5 [true value 27° 24′], and collected information about the course of the Irrawaddy southward, the point of junction of the eastern and greater branch, the Nmai Hka[4], and the route between Burma and Assam through the Hukawng valley further south [57 n.2, 62 n.5].

On the 25th May I paid a visit to the Bura Raja to talk of our return, and was instantly promised a supply of rice and whatever else they could furnish for our journey. He smiled at my offer of payment, and answered that he should be heartily ashamed to accept an equivalent for such trifles[5]. According to promise, a specimen of the tea-tree was brought to me from one of the neighbouring low hills ; it was a full-grown one, about five feet high ; the leaves were coarse and large[6].

At Nambak, on May 31st, we for the first time had an opportunity of observing some lunar distances. On the 2nd June, at an early hour, we were fairly on our way to return, anxious enough to see our neat house at Sadiya, with such comforts as it afforded.

They had an arduous journey homewards, taking a more northward route to cross a higher and snow-covered point of the great range ;

Leaving the Phungan, ... we mounted the wall on its right bank, and there, whilst descending the ridge which divides the waters of the Irawadi from those of the Brahmaputra, a transient clearness gave us a view of our halting place on the Dapha, which we could not perceive without great delight. A short march brought us back into our old path at the crest of the Phungan Pass. ...

We landed at Sadiya. Of those who set out with us on the return, all arrived safe[7] ; and of those of Burlton's men who remained, one...found his way back with another party.

In a letter to the Surveyor General Wilcox tells of some of the troubles on the return journey ;

17th June. I am very happy this time...to tell you of complete success in my undertaking. It has not been without difficulty, & the melancholy loss of two of our party, if not more of those still lagging behind, has been occasioned by exposure & fatigue.

Lieut. Burlton & I have, however, returned in good health[8], as have all the natives of this part of the country, who are more used to the inconveniences of mountain journies. We passed snow still laying in extended sheets on the 4th of this month.

We had the pleasure to sit a few minutes by the Irawaddy's side in lat. 27° 30′[9], where it is fordable & not 80 yards broad ! & whence the source is not more than 50 miles distant[10].

The following occasional notes are taken from his rough diary[11] ;

April 15th. Travel up the Dihing R. ... Barometer readings give apparent height above Calcutta, 1,876 feet. ...

Ten men...were employed in rendering the path passable for the elephant ; however, after passing the Insong[12], the path up hill, on a clayey soil, was so slippery from the rain which had

[1] Now Fort Hertz. The Shans of Hkamti Long were then at war with the Burmese. [2] 7 m. NE. of Fort Hertz, and due E. of Man Se. [3] Nam Kiu rises from range over 16,000 ft., lat. 28° N., about 45 m. N., of Fort Hertz. [4] Nmai Hka rises about 60 m. still further N., and joins Mali Hka 24 m. N. of Myitkyina. [5] as courteous and kind as Shans are to this day. [6] Tea first cultivated in Assam 1836–7. [7] some of them many days later. [8] but full of malaria, see Burlton's note 30th June [62]. [9] Correct within 5′. [10] DDn. 214. [11] Notebook, *IO Cat.* (118–9). [12] stream near Nahong Bum (hill) 92 A/6.

been falling throughout the day and yesterday, that the beast could proceed no further with its light load. ...

Elevation at Roonkoo, on the bed of the Dupha, above Calcutta 1,488 feet. Unfortunately broke two tubes in attempting to boil them [33, 222]. ...

Compared with the difference of latitude from Kasan, the traverse, after allowing for the variation, shewed an error (against observed latitude, a good one, from Ursæ Majoris) of 1.276 miles too much northing. This is easily...accounted for in the uncertain windings. ...

May 4th. It was so difficult today to ascertain the direction that I fully purposed to ...make a better survey on the return ; however circumstances prevented my doing so. ...

We ascended nearly 3,000 feet in the course of the day. We could not see anything of the surrounding country. The guides lost the way immediately they entered the jungle, and the experienced of the party would not...run the risks of advancing in the track of former travellers to be found by cuts in the trees. ... We were all much fatigued. ... Our huts were built of a plant resembling fern[1], and would have proved a sorry defence against rain. ...

May 5th. The latitude of...the end of the day's journey is pretty well ascertained by a bearing on Duphla Mookh, and a bearing on Duphla Bum[2] noted on our return serves to confirm the position in longitude. ... Early the next day I had several bearings on Duphla Bum, which have caused...large reductions...from my first estimation of distance. ...

May 7th. We are on a mountain separating the heads of the Dupha ; snow hangs in the ravines, at an altitude not much exceeding ours, on the mountains on either side.

The following are extracts from Burlton's journal[3];

April 25th. Halted to make preparations for a move by land ; hauled the dinghy up high and dry ; made the loads up for pack.

26th. Found that we had more than could be carried ; left at the village what could ill be spared, wine & solah hats, etc., & started in the rain. Marched up the bed of the Dihing. ... 27th. Left Dihing ; ascended several steep places during the day ; the elephant fell at one and threw its load. ...

29th. The villagers had made the jungle practicable for the elephant ; the beast fell again and was nearly strangled ; for the remainder of the march his load was carried by men. ...

May 2nd. A Burmese who had hitherto wheeled the perambulator was taken ill and obliged to return. The elephant returned to Suddeeya. ...

3rd. Heterogeneous retinue ; Sinpho, Khampti, Mishmi, Moolook, Kainjauns [Kachins ?], and Burmese, all talking Assamese[4].

4th. Guides lose the way in the jungle. ... Heavy rain day after day. ... Leeches. ... Dam-dam flies [blood-blister]. ...

5th. Barometer 7,387 feet up in the hills. ... A number of our fowls had died, and we had only one for today's dinner. ...

7th. Several men ill with fever and swollen legs. ... Barometer tubes broken. ...

8th. Very cold. ... The pass we surmounted is the termination of the left branch of the Dupha. Waters to the west into the Dihing, to the east into the Toonghan. ...

13th. The guides had to cut their way through the first part of the day's march. Left the Nam Shee at its junction with the Nam Long[5], a river 30 or 40 yards wide. ... Burlton has fever, attributed to the rice diet, which certainly does not agree with a European. ... Overtaken by one of the men who had been left behind on the snowy mountains on 8th ; reported the death of his companion. ...

14th. Reached a Moolook village in the evening, and the sight of the houses in the plain before arrival was pleasing in the extreme. ... People most friendly. ...

20th. Reached Maunchu, the local Shan capital ; met by the Rajah's son, and treated with every respect and kindness.

Journal signed at Sadiya, 30th June ;

In the above journal it may be said that too much egotism has been displayed in mentioning our own personal hardships and troubles. They have been mentioned merely that a true idea of the many difficulties to be encountered should be fully known, in order to warn any European from ever attempting the same journey[6]. The chances are much against a man's ever returning alive ; and, even to us who have had much experience in travelling of the same kind, the effects of the journey are not yet known. Lieut. Wilcox is at present confined to his bed with a dangerous fever, & Lieut. Burlton has scarcely recovered. All who accompanied us have also suffered more or less.

[1] probably canc. [2] Dapha Bum, 15,020 ft., 92 A/10. [3] DDn. 224 (26-53) to SG. 4-7-27. [4] for account of these tribes, *v.* Bhuyan (38-41). [5] Nam Lang [*sup*]. [6] Such was the country traversed by the refugees from Burma in 1942.

Hodgson arranged to have the results of this remarkable achievement widely published and brought to the notice of all who might be interested[1];

10th August 1827. Pay thanks to Mr. Burlton for his kind attention in sending the journal which I found very interesting indeed. ... I hope the consequences of the extreme fatigue and privation you so cheerfully underwent will have had no bad effect on your health, and I congratulate you on the success of your undertaking. ... When you are well and the season is suitable, you can do what you think is most needful. ...

I showed your journal to Mr. Swinton[2]; he begged me to make some extracts for Dr. Brewster[3], to which I agreed, and hope it will be not disagreeable to Mr. Burlton and yourself, though I hesitated, considering it as a private paper. I insisted that it should not be published, but it is as well to let Dr. Brewster know something of the merits of the case, as in his journal there was broached some of the...assertions...that the Ereechoomboo was the Irrawady [57].

When you have full leisure, a well-digested official account of your late expedition would do you credit, if prepared for the Asiatic Society, and I would have much pleasure in presenting it [60 n.3]; but if you see any chance of settling the remaining part of the question soon, it might perhaps be as well to wait and bring the whole of the subject into one paper. ...

I wish to have the whole of Assam surveyed geographically, ... but I do not suppose you will have time, as if opportunities are favourable your chief object will naturally be the Duhong[4].

20th August. ... Anything...you can send I can insert in the Oriental Quarterly[5], which is read much sooner than the Asiatic Researches. ... I do not think there can be any better form...than a daily journal of personal adventures like that sent by Mr. Burlton [qv], with...distances marched, and the general directions, and the result of such observations for latitude, temperature, altitude, etc., as you made[6].

Wilcox's paper appeared in *Asiatic Researches*[7], but he was not able to add any further information about the Dihāng. He begged for more attention to the spelling of place names, having spent much of his leisure during the rains in mastering the language;

When I went to the Thethong village I had an interpreter, not *then* understanding Assamese. Of what infinite use has the knowledge of this language been to me! I never could have got a proper person to accompany me; ... the people capable of interpreting are about Mr. Scott. ... I much wish to see some of Captain Bedford's spelling altered. ... The river is spelled Dīhang (ee), but as this sounds harshly, I propose to continue D.W.'s[8] spelling Dihong, & which...approaches *closely* to the pronunciation.

The Dibong...was never yet written Dipung, nor Dipong, nor ever so called in my presence. Capt. Bedford got this from the Domes, who are the lowest...class of society[9].

He now set to work to complete the survey of the Brahmaputra valley, incorporating the work of other officers[10];

28th August. ... My present plan is to survey upwards from Goalpara...to Towang; afterwards to complete the river survey to Suddeeya. There are points, for instance Gowahatty, where for the rocks no measurements can be made, but by triangles on the near hills.

7th September. ... From all that I can learn, the interior survey of Assam will be attended with almost insuperable difficulties. I have just got from Lieut. Jones [54] an average day of bearings in the grass jungle—110 in 7½ miles—and Bedingfield [54, 64] informs me that in Durang, which is comparatively clear, it is little better[11]. I shall be very happy, however, to continue in Assam & draw my allowance whilst my health lasts. ...

I would have tried the Abors on the north bank below the Dihong, though...without hoped of penetrating far. I asked Mr. Scott's opinion today, & he is against it; he thinks that their objections are at present insuperable. ... A grand point of fear with them appears to me to be lest we have designs on the Lama country, & should hereafter want to march through their hills in force[12].

Hodgson agreed on the futility of tedious traverses through waste country;

[1] Records were consulted in 1911, *Explorations NE. Frontier* (5). [2] George Swinton (1780–1854); BCS. 1802–33; Sec. to Govt. [3] Sir David Brewster (1781–1868); Vice Chancellor of Edinburgh University; Ed. of *Journal of Science*; FRS. [4] to Wilcox, DDn. 220 (249). [5] The *Quarterly Oriental Mag., Review and Register*, pub. Calcutta, 1824–8; ed. by Rev. James Bryce. eight vols. BM. PP. 3799. [6] DDn. 220 (253), 20–8–27. [7] *As R.* XVII, 1832 (314 *et seq.*; 412–53); cf. *As J.* XIX, 1836. (195–201) quoting *Friend of India* pub. Serampore. [8] Dick Wilcox ? [9] DDn. 214, 224 (54) 31–7–27. [10] Includes his own maps, MRIO. 171 (13, 48); 172 (36); 173 (36–9). [11] Bedingfield's survey of S. boundary of Darrang, MRIO. Misc. 6–O–28. [12] DDn. 214.

I leave it to your choice what route next to take. ... I do not see what good can be done by exploring the land paths through wastes and jungles, at the almost certain loss of health and very certain loss of time. What we want for geographical and military purposes are the courses of the rivers, and the examination of such roads as may be turned to account for the march of troops ; ... I suppose...2 or 3 of the best routes to Sylhet and Munipoor. ...

As to the size of your map, ... take it as much east and west as you can, adding...from information to what you have surveyed, only taking due care to distinguish each from each ; and you can insert the whole of your survey and as much of Bedford's as you can ; but to make the map thus general it will be necessary to reduce the scale, and 8 miles to an inch may do. ... This, accompanied by a memoir of its construction and of the country, would be a good thing to send to England[1].

He stressed the importance of secrecy ;

28th August. ... You mention Lieut. Jones ; I do not understand why his surveys are not communicated to me ; I suppose they will. What is he doing ?[2]. ... Do not communicate any of your maps of anyone except to me ; it is against orders, and very unusual. ...

28th September. ... I do not want Mr. Jones' eclipses, or anything privately from the Quarter Master General's officers ; if I want anything I will apply for it publicly here. I hope you keep all your observations to yourself[3].

In February 1828 Wilcox was called down to Calcutta to recover his health and complete his maps [3] ;

Lieut. Wilcox, actuated by laudable motives, is endeavouring to prosecute his duty, but as he is evidently in weak health I do not think...that his attempting to do so is likely to be productive of good, and, as it is not adviseable that more arrears of indoor work...should be accumulated, I purpose...to direct Lieut. Wilcox to repair to the Presidency, ... and with the aid I can afford him in the way of writers and draftsmen...to complete a map of the valley of Assam and the contiguous countries[4].

What are we to do about the geography of Assam I know not, except Bedingfield should be put on it instead of the revenue affairs. ... We ought to have a complete map of the valley, and of every stream which flows into it ; also we should have as many hands employed to penetrate in every direction[5].

On his way down Wilcox made a hasty survey of the Brahmaputra from Goālpāra to Jamālpur near Mymensingh [16], reaching Calcutta in June. His map of Assam, scale 4 miles to an inch, completed during 1828, extended from $20\frac{1}{2}°$ to $30°$ in latitude, and from $90\frac{1}{2}°$ to $99°$ in longitude, shewing the source of the Irrawaddy and the eastern branches of the Brahmaputra[6], and including the work of the surveyors in Manipur and Burma as well as those in Assam. The sources of the Mali Hka, the western branch of the Irrawaddy, were shewn at about 28° north, which is approximately correct ; the Tsangpo was shewn in dotted lines as falling into the Dihāng, but its big loop to the north-west round Namcha Barwa was unknown before 1912. A reduction by J. B. Tassin[7] was issued with the journal in *Asiatic Researches* [pl. 7].

Jones, Bedingfield, and Burlton, continued on survey under the direction of Scott, but in April 1829 Bedingfield and Burlton were both murdered by Khāsis at Nongklao on the new road that was being constructed to Cherrapunji [273].

Thomas Brodie and Henry Rutherford surveyed the Goālpāra–Bhutān frontier early in 1830[8].

MANIPUR, 1824–30

The Burmese had overrun Upper Assam and Manipur between 1819 and 1822, and when they threatened Cāchār [51, 52] the ruler appealed to Calcutta for protection. In January 1824 they were repulsed by a small British force, and retreated to Manipur[9]. War was declared on 5th March [52].

[1] Memoir, DLR. M 456 ; DDn. 220 (281) 28–9–27. [2] various surveys between Gauhāti and Jorhāt ; MRIO. 172 (45) ; Reports DLR. M 35 ; BMC. Misc. vol. 13, Routes thro' Khasi Hills MRIO. 37 (24). [3] DDn. 220 (181, 261). [4] from SG., 21–2–28, DDn. 231 (88). [5] DDn. 234 (77), 14–1–28. [6] MRIO. 172 (19–21) ; rough copies, 172 (22–4) ; fair copies, 173 (20–2), in 3 sheets ; cf. 157 (45). [7] Jean-Baptiste Tassin, dmn. & lithographer [298–9]. [8] 26–12–29 to 13–4–30 ; BTC. 5–8–33 (6). [9] Thornton, V (12) ; Bhuyan (514–6).

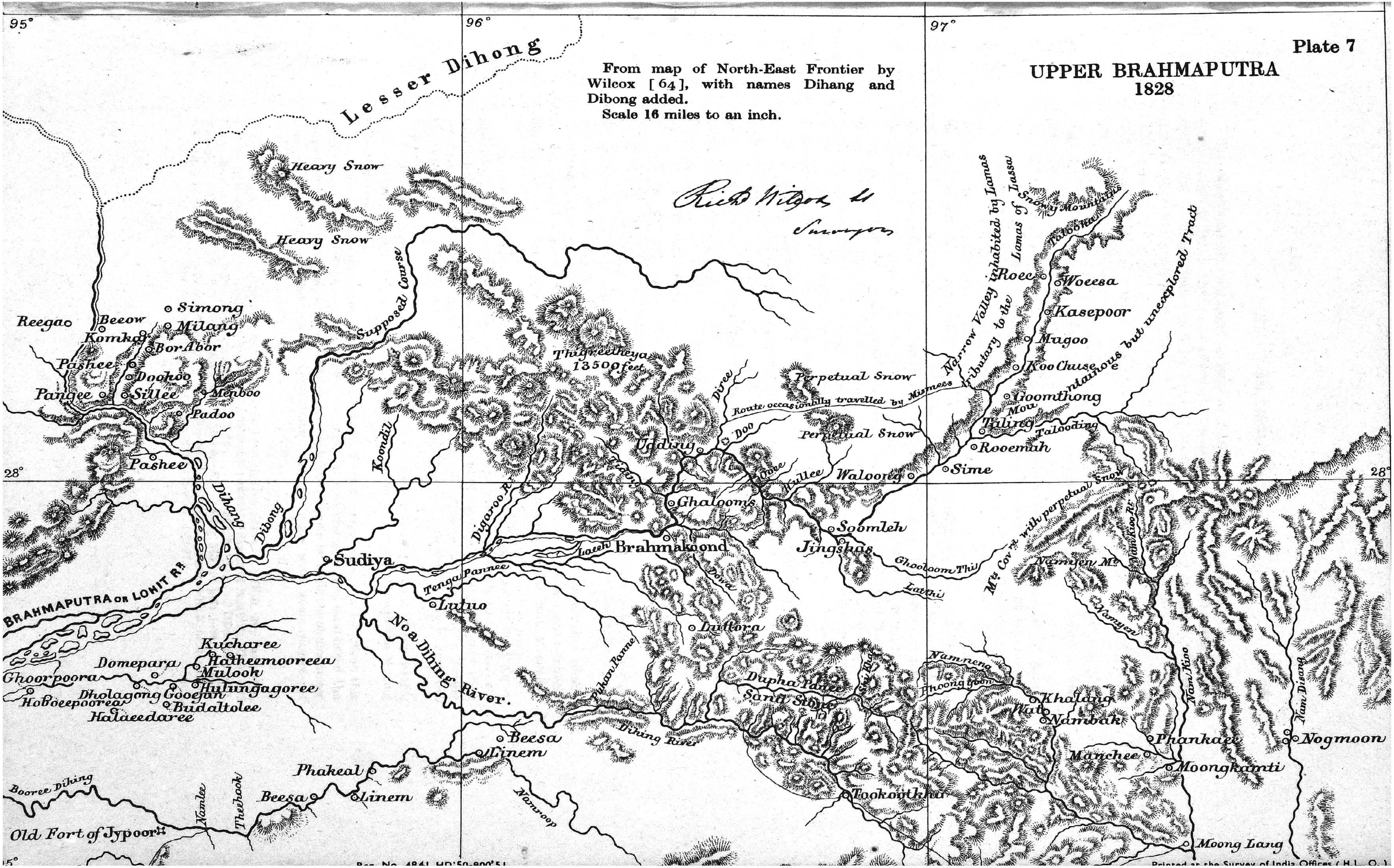
Plate 7
UPPER BRAHMAPUTRA
1828
From map of North-East Frontier by Wilcox [64], with names Dihang and Dibong added.
Scale 16 miles to an inch.
95°
96°
97°
28°
Lesser Dihong
Heavy Snow
Heavy Snow
Supposed Course
Simong
Milang
Bor Abor
Reegao
Beeow
Pashee
Doohoo
Pangee
Sillee
Menboo
Padoo
Pashee
Dihang
Dibong
Koondil
Digaroo R.
Thigreetheya 13500 feet
Diree
Route occasionally travelled by Mismees
Perpetual Snow
Perpetual Snow
Udding
Doo
Ghalooms
Brahmakoond
Walong
Sime
Soomleh
Jingshas
Ghooloom Thi
Lathi
Sudiya
Tenga Pannee
Lutuo
BRAHMAPUTRA OR LOHIT R.
Noa Dihing River.
Luttora
Kucharee
Hatheemooreea
Domepara
Mulook
Ghoorpoora
Hulungagoree
Dholagong
Gooejan
Hoboeepoorea
Budaltolee
Halaeedaree
Dupha Panee
Sana Stone
Dihing River
Beesa
Linem
Phakeal
Beesa
Linem
Namroop
Booree Dihing
Namlee
Theehook
Old Fort of Jypoor
Tookonthku
Narrow Valley inhabited by Lamas tributary to the Lamas of Lassa
Snowy Mountains
Tolooka
Roee
Woeesa
Kasepoor
Mugoo
Koo Chuse
Goomthong
Mountainous but unexplored Tract
Taling
Rooemah
Talooding
Mts Covd with perpetual Snow
Namjen Mt.
Namjen
Nam Kioo R.
Namneng
Phoong Toon
Khalang
Nambak
Phankaee
Manchee
Moongkamti
Nam Kioo
Nam Disang
Nogmoon
Moong Lang
Reg. No. 4841 HD'50-800'51
Printed at the Survey of India Offices (H.L.O.)

The Manipuris also obtained promise of British support, and collected in Cāchār under Gambhir Singh to co-operate with Shuldham's force which advanced from Sylhet and occupied Bānskāndi in February 1825. Owing to obstacles of road and weather the attempt to reach Ava by way of Manipur was abandoned, and Shuldham's force broken up. Gambhir Singh was, however, encouraged to continue with his own irregular troops, "and in less than a month had succeeded in turning the enemy out of Manipur"[1].

The surveyors posted to Cāchār had been Birnie Browne, Pemberton, and sub-assistant Macpherson, all from the revenue surveys. Shuldham's force, writes Pemberton,

remained in camp for some time at Banskandee, ... on the right of the Soormah or Barak River, while attempts were making to clear a road through a dense and almost impervious... forest, which stretched from the bases of the mountains, forming a natural boundary. ...

On 31st [December] 1824 I left Banskandee, accompanied by a small guard of Ghumbeer Singh's Munyporeans & nine elephants for transport.

He and Browne carried survey as far as the Kuki village of Tangum by April, and then Pemberton went forward with the Manipuris[2], whilst Browne and Macpherson were transferred to Burma [73]. On 14th June Pemberton reported the occupation of Manipur[3]. In September the Surveyor General reported that

Lieuts. Browne and Pemberton...made a survey of about 150 miles of route beyond the frontier[4]. ... Lieut. Pemberton has since surveyed the road to Manipore and partly back, about 112 miles[5], and Lieut. Browne, having come to Calcutta by orders from the Quarter Master General of the Army, has since been detached to Prome. ... Lieut. Pemberton will return to the Silhet frontier after the leave on which he is now in Calcutta[6].

Pemberton returned to Sylhet in December to rejoin Gambhir Singh at Manipur, and explore communications between that country and Assam and Tripura. He arrived in time to accompany Gambhir Singh's advance into the Kabaw valley in pursuit of the Burmese, and reported from Tamu[7] that he had surveyed the route, with observations for latitude, and "a series of barometrical observations for ascertaining the altitude of the various ranges"[8]. He then returned to Cāchār by a new route, and thence to Rangpur, capital of Assam[9].

In February 1827 he reported from Kabaw that he had reached Manipur on 7th January by the Kala Naga route;

The whole of this route I have resurveyed as, my first visit to Munipoor being made during the rains when we were compelled to hasten in by forced marches, the observations then noted were unavoidably defective. ...

I remained at Munipoor but two days, and again marched to the Kubboo valley where, recommencing my survey from the Tumnoo stockade, I have extended it in a south-easterly direction to the right bank of the Ningthee River[10], opposite a Burman stockaded village. ...

I have made every preparation for going from the Ningthee to Umeerapoore[11], but I regret to say that my progress was there arrested, and permission to advance firmly though respectfully refused until the sanction of the King of Ava should be obtained. Not being more than ten days distant from the capital of the Burman empire, I wrote to the Resident[12] soliciting the exertion of his influence in obtaining the necessary sanction. An answer may be expected in a month. ...

I have been compelled, in consequence of this opposition and from want of provisions, to return this far, and shall tomorrow commence the survey of a route through the Meuing hills to Munipoor. ...

In traversing the numerous ranges of hills which form so characteristic...a feature in this mountainous region, I have made several barometrical measurements, and established the latitudes of all places of importance...with an excellent reflecting circle, while the chronometer you...lent me has enabled me to approximate the longitude with some degree of confidence[13] [3].

[1] *Frontier Expeditions, Burma* (42); Pemberton (47) Bhuyan (546). [2] DLR. 39; Pemberton, 1-4-28; DDn. 230, 6-6-25. [3] *As J.* Jan. 1826 (100) & HMS. 666 (440). [4] Sketch of Barak R., MRIO. 173 (13). Route of Shuldham's Div. from Sylhet, ib. 37 (21, 23). [5] ib. 36 (29-32). [6] DDn. 204 (199), 20-9-25. [7] 83 L/8. Fdbks. DLR. 37-39; Maps, MRIO. 36 (6, 8). [8] DDn. 213 (91), 24-1-26. [9] DDn. 220 (146), 14-4-26. [10] or Chindwin [78-9]. [11] Amarapura, the old capital, about 6 m. S. of Mandalay. [12] John Crawfurd [78]. [13] to Hodgson, DDn. 204 (308); 213 (115-20), 4-2-27.

He now had the assistance of George Gordon, of the Manipur Levies, having always, indeed, received "very cordial assistance and friendly aid" from Gambhir Singh[1]. By July he was able to submit

a map of the whole Territory of Munnipoor, the greater part of which...has been actually surveyed during the present season. ...

A very cursory view of the nature of the boundary defined by the course of the Muneepoor and Nurinjeerah Rivers clearly shows how desirable it is that they should form the limit of the Muneepoor territory in this direction. ... Many years, however, have elapsed since the conquest by the Burmahs, and there is every reason to believe that they will strenuously oppose any attempt to restore it to its original masters.

During the late war, a detachment from the troops of Raja Gumbheer Singh crossed the hills...and expelled every Burmah from Kubo as far south as Kumbat, while the Raja after capturing...Tummoo marched from thence to Sumjoh and Monfoo. The Munnipoorees have ever since continued in possession of the valley. ...

Should it be determined to make a final adjustment of the boundary between Munepoor and Ava during the ensuing season, ... nothing should be wanting to give the measure its due ...importance in the minds of the parties principally interested and, unless some decisive steps are immediately taken, it is highly probable that the Burmahs, who have never renounced their claim, will again endeavour to re-establish themselves in Kubo, ... which will, of course, be opposed by the Raja of Muneepoor, and must...lead to a renewal of...bloodshed and devastation[2].

His work was greatly appreciated at headquarters, and the Surveyor General welcomed his map ;

It will be a valuable addition to our eastern knowledge, and from your frontier we can lay our hands on Ava whenever we please, having the weather gage, as the sailors would say, in our favour. All we would require would be abundance of pioneers to make your hilly paths a little better, though, as they are, you could shew a light force very soon in a position to make the Golden King run away from his capital[3]. ...

I will give the Government a copy of your map and papers as soon as they arrive and can be copied[4].

During 1828 Pemberton was appointed member of a commission for the settlement of the Manipur–Burma boundary. After the usual delays waiting for the Burma fellow-commissioners, and endless discussions and disappointments, a satisfactory line was agreed upon, and the Commissioners received the congratulations of the Governor General in a letter dated 30th April 1830[5].

Pemberton was able to extend his surveys all along the frontier, and when the boundary business was concluded he travelled down to Ava, and then across the Yomas to Arakan [71]. Leaving Manipur on 15th July 1830, he passed Tamu on 21st, and reached Ava on 13th August and after a month there he went down the Irrawaddy to Minbu, and reached Arakan on 1st October[6]. He then reported to the Governor General at Allahābād[7].

[1] DDn. 213 (323), 3–5–27. [2] ib. (330), 8–7–27 & HMS. 671 (679). Kabaw valley peacefully restored to Burma in 1834. [3] The road from Manipur to Mandalay in 1944 was not so easy as all that. [4] DDn. 220 (278), 22–9–27. [5] HMS. 672 (461). [6] Maps, Manipur to Amarapura, MRIO. Misc. 6–O–25. Eastern Frontier, 12 sheets, 16 m. to inch; *IO Cat.* (171). [7] Journal HMS. 677 (323), 9–11–30.

CHAPTER V

BURMA

Chittagong–Arakan Frontier, 1823–4 — Arakan Campaign, 1824–6 — Irrawaddy River, 1824–6 — Martaban & Tenasserim, 1826–8 — Maps & General Surveys, 1824–8.

IN September 1823 Burmese from Arakan attacked the British post on the island of Shāhpuri at the mouth of the Nāf River, killed four sepoys, and then withdrew. Two companies of infantry were promptly sent down to occupy Shāhpuri[1], and the magistrate of Chittagong was ordered to meet Burmese deputies with John Cheape as surveyor [52], and demarcate the frontier.

You should proceed in person during the present cold season and...endeavour to...define the whole extent of the disputed frontier, assuming the Morussee River as the boundary acknowledged by the Burmese themselves in 1794. ...

The final adjustment of the boundary line should be settled in communication with the Burmese. With this view the King of Ava will be requested to direct his local authorities... to depute someone on their part to attend. ... It is not intended, however, that the survey ...should be suspended on account of the non-attendance of a Burmese officer, after allowing a reasonable time for his joining you. ...

It is understood from Captain Cheape that it will not be difficult to fix a sufficiently distinct boundary, ... taking certain rivers as the general line of demarcation, and where these may be wanting by digging trenches or erecting pillars as landmarks. This is the more requisite as most of the recent disputes with the Burmese have originated in that quarter to the south-east of Ramoo...which is visited by our elephant hunters[2].

Cheape wrote from the Nāf, asking for

boats, which are not procurable here, and will be absolutely necessary to an accurate survey, as well of this river as of those running into it, their banks being covered with impenetrable jungle. ... On these rivers being surveyed...I purpose going inland...defining the boundary as nearly as possible ; but...I must beg...for the requisite guard being furnished, ... as well as for elephants, etc., for the carriage of camp equipage and supplies through so difficult a country. ...

Having been over occasionally to the opposite country and received very civilly, no obstacles made to going about, ... I have desired them to write to Arakan for a man of rank... to accompany me up the Mooroosay as far as we can, and thence by land along the boundary...to Ramoo, where...all matters can be settled. They seemed much pleased with this arrangement, and I do not apprehend there will be any difficulty. ... Their claim to Shapooree ...has been referred to Ava ; it must, however, be a mere point of honour with them, as they ridicule the idea of two great states going to war for the possession of such a place[3].

In spite, however, of their apparent friendliness, and obviously under instructions from Ava, when the Chittagong magistrate joined Cheape in January 1824 the Burmese demanded the unconditional surrender of Shāhpuri and withdrew when this was refused. Shortly after, they seized the officer commanding the pilot vessel, and this, coinciding with the threat towards Cāchār [52, 64], brought a declaration of war on 5th March[4].

Cheape's map covered the coast north and south of Cox's Bāzār, and extended east to the Mayu River. It showed all the tributaries of the lower Nāf, distinguishing those inserted from actual survey[5]. A rough 12-mile sketch of Chittagong and Arakan, compiled in the Surveyor General's office before Cheape's survey, is the earliest map known to have been lithographed at Calcutta [298–9][6].

[1] Thornton, V (9) ; Alexander (chronological table). [2] Ramu, 84 C/3 ; DDn. 193 (24), 8–10–23 ; BSC. 7–11–23. [3] DDn. 204 (18) & 213 (11–2), 22–12–23. [4] Pogson (122). [5] MRIO. 175 (18). [6] dated 13–10–23 ; HMS. 678 & MRIO. Misc. 6–O–20.

ARAKAN CAMPAIGN, 1824–6

The first military action on the Arakan front, after the declaration of war, was taken by the Burmese. Soldiers from a force assembled in Arakan crossed the Nāf early in May 1824, and practically annihilated the British detachment at Rāmu. Owing to the monsoon, it was not until September that orders were given in Bengal for the assembly of an army at Chittagong under the command of Brigadier General Morrison[1]. Surveys were entrusted to a small temporary corps of pioneers, officered partly from the revenue surveys of the Upper Provinces. They were formed into three companies under the command of Major Schalch, and employed on roads and bridges as well as survey[2].

The advance did not commence until January 1825, and Teknāf[3] was reached on 1st February. The force was supported from the sea by the two surveying vessels *Research* and *Investigator*, each fitted with ten guns. Sailing in the *Research* Commodore Hayes led a small armed flotilla up the Kaladan River[4] to reconnoitre. On the 23rd February they came abreast the stockades at Chamballa, and a sharp engagement took place which resulted in the withdrawal of the flotilla. Amongst other casualties Schalch died two days later from a bullet wound[5] [182].

Wroughton was now left in charge of the survey, and had as assistants Crommelin and Thomson of the Engineers, and Nelson, Dumbleton, and Schencks of the revenue surveys. Amongst the many routes surveyed was one by Wroughton and Thomson between 21st and 23rd March. They landed south of Moungdaw, crossed the central ridge of the Mayu peninsula, followed a track parallel to the right bank of the Mayu River to the south, and then worked their way back over the hills to the sea[6].

Crommelin and Wroughton surveyed the route of the main force from Moungdaw[7], which crossed the Mayu River on 20th March, and on 31st after a sharp fight occupied Myohaung[8], at that time capital of Arakan [12]. Wroughton made a detailed sketch of the city defences on the six-inch scale[9], and Drummond, of the Quartermaster General's department, sketched the route to the east by which the Burmese retreated. Surveys were much interrupted by sickness and other duties, and by the rapidity of the marches [3]. Wroughton had to take sick leave to Bengal, and reports later that

the progress of the south-eastern division, and the various obstacles...occasioned by the myriad of side streams and rivers of great magnitude, rendered it utterly impossible for any steady proceedings...by the surveyors ; ... ignorance of the country...obliged Brigadier Morrison to make constant use of the surveyors in reconnoitring, ... the officers of the Quarter Master General's department being completely occupied on other matters. ...All papers, among which were several field books of the survey, ... were transmitted to the Government by the late General Morrison. ...

Fair protractions were sent to Government of all such routes followed by the division, and in some instances...diverging from the general course. ... The extraordinary marches on many occasions...rendered it quite out of the question for one surveyor...to make up the route, and...Crommelin and self regularly divided the survey of each march, either he or self proceeding ½ of the way, and there leaving a flag from whence either party closed, and the other brought up the survey to it from ground quitted in the morning. ... On arriving at Arracan, these documents were left with Crommelin, who made out as good a plan as could be drafted from the...joint operations ; this plan was sent into your office, and is as good...as could be drafted[10]. Crommelin agreed to this division of the work. ...

What with the detachment being sent under the poor Major [Schalch], and then in the General's hand, and from thence turned over to the Quarter Master General, and finally made over to the Surveyor General, it was quite out of the question to proceed upon any clear instructions, and thus we were left to the mercy of General Morrison who...employed his surveyors in reconnoitring...when we had completed the survey of the route[11].

1 about 25,000 strong ; Joseph Wanton Morrison, HM. 44th Regt. ; d. 15–2–26. 2 BSC. 10-9-24 ; HMS. 664 (137). 3 12m. above mouth of Nāf R. 4 On a creek E. of Kaladan R., *c* 15 m. S. of Myohaung. 5 Low (437). 6 MRIO. 156 (72). 7 ib. (45, 51–2), etc. 8 84 H/2, 40 m. NE. of Akyab ; see *Imp Gaz.* XVIII (160–1). 9 MRIO. 157 (1–3), beautifully drawn, 11–4–25. 10 ib. 155 (17–9) ; 4 m. to inch ; with 8 m. reduction. 11 to SG., DDn. 225 (111–6) and 215 (48), 29–4–27.

This report came long after the dispersal of the surveyors, and, at the time, the Surveyor General only knew that

three officers, Lieuts. Wroughton, Thomson, and Crommelin, stand appointed there, ... the first being on leave to Benares since 1st of June. ... Lieut. Crommelin has been employed during the rainy season...in constructing a map of the country from Mungdoo[1], but I have gained no information of any survey except that of a part of the new road from Chittagong to Cox's Bazar. ... Both the Engineer officers advert to other duties which require their occasional attention, and which they declare to be paramount to their survey duties. ...

On the expiration of Lieut. Wroughton's leave on the 10th proximo, there will be three independent surveyors with the Arrakan Force. ... It appears to me, therefore, ... that Lieut. Wroughton, with the aid of his sub-assistants[2], will be found as equal to the duties of that division as either of the officers similarly attached to the Ava and Assam forces[3].

On the strength of this recommendation, Thomson and Crommelin were relieved of survey duties, though somewhat prematurely, for Wroughton never rejoined. The army became impatient for maps, and the new commander, Brigadier General Richards [52], wrote that,

since Lieutenants Thomson and Crommelin have been taken away from the survey department, there has been no one left here to carry on those duties, as all the officers of the Quarter Master General's department have been obliged to quit Arrakan on sick certificate ; I have therefore reappointed Lieut. Crommelin...as it is absolutely necessary that the islands at the mouth of the river (especially Akhyab), as likewise its right bank up as far as Piekeon, and then its left down to Arrakain, should be forthwith surveyed. ...

I have no map whatsoever...of this part of the country, from survey or information, to be depended upon. The one that was furnished by Capt. Drummond, Qr. Mr. Genl., was given to Brigadier Genl. Morrison, C.B., who took it with him to Calcutta[4].

Reference was made to Morrison, who said that all the route surveys had been handed over to the Commander-in-Chief, and that the two general maps compiled by Drummond and Crommelin had been given to the Quartermaster General[5].

On reversion from survey duties Crommelin had returned all instruments to the Surveyor General's office, and on being re-appointed to survey the islands at the mouth of the Arakan river, he

proceeded about the beginning of November in the Dragon schooner[6] with Lieut. Thomson for that purpose. I was thus employed till the beginning of December 1825. At this time the Dragon drove on shore in a gale, and was rendered unserviceable for some days. On the arrival of Commodore Hayes [68, 70 n.5] about 22nd December, she was made over to...the sub-commissioner. Owing to this deprivation, and the departure of Brigadier Richards, together with the death of the next officer who came into command...and the consequent confusion of all business, ... I did little besides drawing until the arrival of Brigadier Innes[7]. ...

I have just received orders to hold myself in readiness to proceed across the Yamatong mountains for the purpose of reconnoitring the Aeng Pass [71]. ... For this interesting duty I have scarcely a pocket compass, nothing wherewith to determine the height of the mountains, or even a sextant. The absence of a perambulator will not be of any moment, as the use of it must be totally impracticable over such steep and rocky ground[8].

In another letter he writes ;

Brigadier MacInnes having arrived, and intimated his intention of taking me to Sandoway, Ramree[9], Cheduba, Amherst Island, &c., for the purpose of making military sketches of the ground chosen for cantonments, ... I am totally deficient with regard to instruments, men, paper, perambulators, &c.[10]

In spite of this handicap he was able to produce a "sketch of the creek navigation from Sandoway to Toungoo and Ramri Roads, traversed by Brigadier MacInnes[11] in his inspection tour on the Arracan frontier".

MacInnes at the same time appointed Frederick Birch to extend this survey ;

The tour in which I was engaged...through the inland navigation of these provinces impressed me with the importance of having the intricacies of that navigation accurately surveyed, and...defining the creek routes from at least one station to another. Lieut. Birch being...

[1] Maungdaw, 84 D/5. [2] Schencks & Dumbleton [68]. [3] DDn. 204 (199), 20–9–25. [4] DDn. 215 (27), 22–11–25. [5] DDn. 201 (187), 7–12–25. [6] comdd. till August 1825 by Horatio Nelson [151]. [7] John MacInnes (177–1859) ; Ben. Inf. ; Hodson, III (146). [8] DDn. 213 (101), Sandoway, 1–3–26. [9] Sketch of Ramree, MRIO. 157 (59). [10] DDn. 213 (99), Akyab, 3–2–26. [11] MRIO. 175 (4), March 1826.

qualified for this duty, and about to return to Bengal with the only set of instruments nearer than Calcutta, determined me on availing myself of his services immediately[1].

It was not only instruments that were lacking, for, writes Birch,

to carry on a survey in a country so intersected...with large extensive rivers (in some places almost seas themselves), with any satisfaction to the surveyor, ... a boat, sea-worthy in every respect, and with a sufficient crew, is an absolute requisite, and to procure & to keep up such a one my allowance would be totally inadequate ; putting out of the question the necessary establishment of classies, & who could only be induced to remain in that climate by the lure of increased wages.

The greatest difficulty has all along existed in procuring a very few *coolies*, at the enormous expense of 8 rupees each man per mensem, ... and at present neither coolies or boats are to be hired or brought for any sum. Lt. Crommelin and myself have hitherto had the advantage of the Commissioner's pinnace, but that is now required for other purposes, and without boats or other establishment of any kind I am at a loss how to employ myself. ...

If there is any survey required in another part of India, where the greatest attention to the duties, ... and the exertion of what qualifications I possess, may be of use, ... you will so far oblige me by bringing me to the notice of Government ; otherwise...[I] would prefer rejoining my corps[2].

In his formal resignation Birch pleaded that his "constitution is incapable of combating the climate of this country[3]", and troops who fought the Japanese in the campaigns of 1942–4 will appreciate the verdict of 1826 ;

Arracan has proved the valley of death and, after almost destroying General Morrison's army, is found to be too unhealthy even for those regiments stationed on the islands and sea-coast[4].

Marine surveys of the coasts, creeks, rivers, and harbours of Arakan were carried on continuously from 1824 till after 1830 by officers of the Company's marine service and His Majesty's navy, amongst whom were Henry Hardy, John Crawford, Armstrong, Bowman, Criddle, Montriou, mostly under the orders of Commodore John Hayes[5] [17].

IRRAWADDY RIVER, 1824–6

The main British army under Sir Archibald Campbell[6] occupied Rangoon in May 1824, and having beaten off strong attacks there during December started to advance up the Irrawaddy in February 1825. Prome was occupied at the end of April and Pegu in September. After an advance of about forty miles above Prome, the army settled down there for the rains of 1825, and did not resume the advance till December when, after the defeat of a large Burmese force, a move was made towards Ava, and negotiations opened. As the Burmese court still remained obdurate, a further advance was made to Yandabo[7], where a treaty was signed on 24th February 1826, under which the Burmese renounced all claim to Assam, Cāchār, and Manipur, and ceded Arakan, Martaban[8], and Tenasserim [1].

The only knowledge of the geography of Burma was from early marine sketches, and the maps and reports made by Wood and Buchanan in 1795 [I, 84–5]. It was uncertain whether it would be easier to reach Ava by way of Manipur, Arakan, or Rangoon[9].

Thomas Trant, of H.M. 95th Foot, who was the most useful surveyor on the Q.M.G.'s staff, records that on the march to Prome,

as the country was quite unknown to us, and...we could not rely upon the assertions of our guides, an officer of the Q.M.G.'s department was daily sent with an escort of cavalry in advance of the army, and directed to select a position for the ensuing day's encampment. ...

[1] "Survey of the creek route between Akyab, Talack and Aing" by Crommelin & Birch, April 1826, SE. from Akyab ; MRIO. 174 (20–1). [2] DDn. 213 (113), Akyab, 9–5–26. [3] DDn. 211 (34), 14–5–26. [4] Trant (308). [5] MRIO. 100 (7–10), 101 (27–9) ; 102 (31) ; 105 (37) ; 174 (28) ; 175 (8–13) ; Hayes (1767–1831), IN., Master Attdt. Calcutta 1809 ; commodore, Java expn., 1811 ; d. 3–7–31, at Cocos I. [6] (1769–1843) ; of HM. 38th Foot, *DNB*. [7] 84 O/6, 12 m. above Myingyan. [8] Martaban district was renamed Amherst, after the GG., but the town on right bank Salween remained Burmese [74]. [9] Gleig, II (136).

About this time a very singular personage arrived at Rangoon, who it was hoped would prove of the utmost use to the army. This was a man named Gibson, born at Madras, and son of an Englishman and a native woman. He had passed almost all his life in Ava, and had been frequently employed by the Burman monarch in situations of trust. ... From him an extensive map he had compiled of the Burman Empire was procured ; and although extremely incorrect, yet, as it gave a great deal of general information and was with the exception of Wood's map the only document of the kind we possessed, it proved of much service[1].

The map here accredited to Gibson had been compiled at Penang with his assistance by Henry Burney, and copies lithographed at Calcutta [79–80][2]. Unfortunately Gibson died of cholera on the march up to Prome ;

He had made himself very useful, and his loss was difficult to be replaced, as we had no one with us equally well versed in the duplicity and insincerity of the government we were opposed to[3].

In his book describing the campaign Trant includes several of his own maps ;

Map of the Burman Empire, corrected from the latest information ; ... scale one inch to a degree—Plan of the Fort of Denobiu, surrendered to the British Army on 2nd April[4]—Plan of the route of a detachment of the British army from Pakangyeh in Ava to Aeng in Arracan, during the month of March 1826. Scale 4 miles to an inch[5].

This detachment whose route over the Arakan Yoma was surveyed by Trant comprized the 18th Madras Infantry, 50 pioneers, 36 elephants, and 100 pack bullocks. Pemberton followed the same route in 1830 [66][6], and made a series of barometric observations, which, he writes, "will prove a useful addition to Lieut. Trant's sketch"[7].

Other military sketches include Rangoon and Syriam[8] by Trant, and surveys round Prome countersigned by James Jackson [12][9], who as Deputy Quartermaster General to the force could spare little time for actual survey himself, but gave every encouragement to others. It was at his request that in June 1825 an experienced surveyor was sent to Burma in the person of Peter Grant [20–2, 152] who had just returned from sick leave at the Cape, where he had been studying astronomy with the astronomer-royal [183]. Well provided with high class instruments [213] he sailed from Calcutta on 28th June, to be welcomed at Rangoon with a friendly letter from Jackson ;

I shall arrange everything for your accomodation up the river, but our Chief has no soul for science, and even hates the very word, because it takes him beyond the powers of his very comprehensive mind. I have had nothing but opposition to every thing I wished to do in this respect since we arrived here, i.e. in the Burman dominions[10].

Grant had but little support from the Quartermaster General at Calcutta, and was glad to be transferred to the control of the Surveyor General with the other revenue surveyors [333].

Pressing reference having been made from the D.Q.M.G. to the forces in Ava for an officer to make astronomical observations, it occurred to the Q.M.G....to select me for this duty. I cheerfully assented...under an assurance that all my wishes should be complied with, and every expence defrayed. ... With these assurances I left the Presidency at only 5 days notice, expecting shortly to be supplied with an assistant and to have all the aid of the office establishment of D.Q.M.G. ; but neither arrangement emanated from that department, and I was left singly to wade through the labour.

Though I received no instructions from the Q.M.G., being left apparently to act at discretion, I was so fully acquainted with Colonel Blacker's views that these alone were sufficient to guide my survey. ... I therefore immediately on my arrival at Rangoon (15th July) addressed...the Brigadier for a spot on which to erect an observatory, and on the 24th it was built, and the transit instrument and large astronomical circle put up [213, 216].

Besides astronomical instruments he took barometers, and kept careful record of their readings[11]. In October, after having fixed the position of Rangoon to his satisfaction [183–4], he moved up the river and reported to headquarters beyond Magwe, where he found

[1] Trant (69). [2] MRIO. 154 (6) ; DDn. 19 (45–57), 5–11–24 ; HMS. 663 (503–6). [3] Trant (159). [4] Danubyu, on Irrawaddy, 17° 15′ N. ; MRIO. 191 (3). [5] Pagān, 84 K/16 ; An, 85 E/13 ; MRIO. 156 (25, 58). [6] Present mule track from Minbu crosses the Yomas, lat. 19° 45′ N. at height of 4,590 ft. ; HMS. 677 (323), 9–11–30. [7] MRIO. 156 (5, 62). [8] *Ben Regr.* 484 (79–80) ; MRIO. 191 (10, 18–9). [9] ib. 156 (61) ; 191 (15–6). [10] DDn. 216 (34), 4–8–25. [11] Journal, DDn. 239, M 421.

the latitude of the great Pagoda is 20° 10′ 45″[1]. The river opposite Yennangyoung[2] branches off into innumerable islands, extending as far as the eye can reach to the westward. The Arrakan mountains do not appear in one continuous chain, but in conglomerated masses. I should think their greatest height does not exceed 3,500 feet[3]. I regret that I could not proceed higher up the river ; a base of 12 miles would have enabled me to determine the position of every mass and remarkable peak.

I had carried the survey of the Irrawaddy as far as Yennangyaung when I met the commander of the force on his return to Prome.

Returning to Prome, he was given the assistance of Thomas Blackwell, whom he employed "in the construction of a general map[4]" which shows the Irrawaddy in detail between Prome and Yenangyaung, with hills on either bank, and routes from Prome and Meady across country to Toungoo. He pressed the importance of a general survey, but the necessary escorts and transport could not be provided ;

How it happened the Pegu River was not surveyed as high as boats could go is a circumstance not easily accounted for. Though boats and brigs were constantly going up to Pegu, nay, troops were there 8 months, its position is still deemed uncertain. It is proper to add, however, that part of the river was surveyed by Lieut. Trant[5].

During the whole campaign, no astronomical observations were made at Pegu. It is said to be only 60 miles from Rangoon by the perambulator, in which case its latitude would be about 17° 30′. ... Wood made it 17° 19′ 34″[6].

He reported to the Surveyor General in November ;

The only survey hitherto made in this country is...of the route of the army. ... Lieut. Trant has laid in the details of the river, having assumed the distances in Wood's map as the basis of his survey, which however is erroneous by about 7′. The only astronomical data ...are a few observations for the latitude made by Captain Jackson as often as leisure from other duties would permit. Captain Steel [II, 321] is the only officer in the whole army who can make astronomical observations, but the more immediate duties of that department [Q.M.G.'s] must necessarily preclude particular attention to such an object, and in a country like this, so much broken and of an undulating surface, perambulator distances are not to be depended upon. ...

I am in daily expectation of seeing the assistant whom you have sent with Lieutenant Browne, when I shall be able to form some plan for proceeding into the interior[7].

In August 1825 Birnie Browne, now available from the Cāchār front [65, 151] was sent to Burma. He took two assistants, Macan and Macpherson [333], and reported from Prome on 11th December ;

The General has been pleased to place me at the disposal of Captain Grant. ... I made a sketch of the river from Rangoon to Prome. ... I merely used a pocket compass, and estimated the distances by my watch. I had a few observations for latitude which I have marked, and which agree pretty well with the sketch[8].

He and Macan later carried the survey up the river to Pagān[9].

Grant spent several weeks at Prome over his astronomical observations ;

After I shall have completed my observations for the longitude I shall...consider...extending my observations, both trigonometrically and astronomically, to the eastward and westwards. ... The chief obstacles are want of carriage, ... interpreters, and guides ; ... these must be obtained from the...country, and the facility of obtaining them [depends on] the successful progress of the army, and the total expulsion of the enemy from the tracts and routes to be surveyed.

Granting, however, that this object was fully obtained, still it would be hazardous...for surveyors to travel in a savage country, and among a barbarous, not to say ferocious, population, without an adequate escort. ... Escorts have been promised, but once the army is at a distance I shall not be able to press the subject personally. The General has also offered to authorize the hire of Burmese carriers, interpreters, and guides, if procurable, and the requisite boats for the survey of the river[10].

8th December. ... Sir A. Campbell left this with the army on the 1st instant, and will probably reach Meady on the 15th. Since his departure Lieut. Browne has arrived, ... too late to join the army, and even if he had come sooner he must have delayed in order to obtain

[1] True value 20° 9′. [2] 84 L/15 ; now the centre of the oil-fields. [3] Sun Taung, 6,527 ft., 50 m. due E. of Yenangyaung ; *gy* pronounced *j*. [4] MRIO. 157 (10). [5] DDn. 240, M 420. [6] True value 17° 20′ N. ; Journal, DDn. 234, M 421. [7] DDn. 216 (48), 17-11-25. [8] Map, MRIO. 174 (2-6). [9] ib. (8-12). [10] DDn. 216 (63-9), 4-12-25.

carriage. Moreover, ... there are so many surveyors in the department of the Quarter Master General that his services with the army would have been superfluous. ...

The arrangement, therefore, by which Lieut. Browne is placed at my disposal leaves him entirely to act at his own discretion. As soon as the commandant of the garrison...shall consider it safe to grant an escort, I shall recommend him to take the route to Tongoo, and thence to Pagahm Mew or Ava, as he may judge proper[1].

Grant left Prome during February and proceeded up the river ;

Meady. 28th February. ... I am thus far on my way in progress to Pegahm Mew, and thence to Ummerapoora. Sir A. Campbell was to have left Pagahm Mew on the 16th, and it would have been of no advantage to me to have left Prome sooner, as my operations must be in rear of the advance. Anticipating the conclusion of the war before the army reaches Ummerapoora, I trust nevertheless to be able to reach Pegahm Mew before the army retrogrades. The opinion is that Ummerapoora is placed too much to the eastward. ...

Should peace take place, I shall arrange with Sir A. Campbell about returning to Rangoon, thence proceeding to Pegue, Mergui, Bassein, and Calcutta, as I should not wish to remain in this country after the position of these places shall have been determined[2].

He surveyed up to Amarapura [65 n.11] and then returned to Prome. He had at one time hoped to survey across the Yomas to Ramree on the Arakan coast, but his health was not fit for so difficult a journey, and he left it to Browne. Accompanied by Macan, John Brady of the Artillery[3], and an escort of 20 Madras sepoys, Browne left Prome on 19th March and dropped down the river 8 miles to Padaungmyo. Starting out from there on 23rd, he reached Taungup in the Sandoway district on 1st April[4]. He reported later that

this dangerous and hitherto unexplored tract...can never be available for the march of an army, and would only answer the purpose of a dawk communication, as which it [would be] of great public utility...being only 6 days journey. ... We went thro' a country covered with bamboo jungle ; found the first ascent in the great range of the hills of Youma practicable only by single men on account of the narrowness of the pathway[5].

He speaks highly of help received from the "Mug chief and his followers", whom he rewarded

by...such articles as their cupidity held in most esteem, viz., my fowling piece, a pair of pistols, and two swords, which I trust will meet the approbation of the Goverment.

The privations under which we laboured from want of food & water at various periods when we could procure none, except by descending to the vallies, and procuring it ourselves by digging for the latter, was such as cannot be described. I beg to subjoin a list of the missing during our journey, but I yet cling to the hope that some of the stragglers may have reached Prome in safety. ...

Lieutenent Brady, who volunteered to accompany our party, was attacked in the line of march with jungle fever, and died the day of his arrival at this Presidency[6].

In describing this trip and the similar one by Trant [71] the *Calcutta Gazette* comments, 20th April 1826 ;

Whilst these successful excursions promise to lay open the unknown topography of the mountain boundary between Arracan and Ava, arrangements...have some time since been instituted to obtain accurate surveys of Pegu and the delta of the Iravadi. Captain Grant, surveyor in Ava. is actively engaged in this duty, and we learn that considerable progress has been made...of the first importance to the geography of this part of India[7].

Grant's final map shewed the Irrawaddy River from Yenangyaung to the sea, and the Rangoon River, on the scale of 4 miles to an inch[8]. His most valuable work was his series of careful astronomical observations for latitude and longitude [3, 183–5].

MARTABAN & TENASSERIM, 1826–8

Tavoy and Tenasserim were surrendered to the British on 30th October 1824 after an expeditionary force had captured in turn—Tavoy, 9th September—Mergui, 6th October—Martaban, 30th October.

[1] Pagān (myo, pronounced *mew*, = city), 84K/16 ; ib. (69). [2] DDn. 221 (138). [3] John Brady (1806–26) Ben Art. 1824 ; d., Dum Dum, 13–5–26. [4] Map, MRIO. 156 (55–7) ; (8–12). [5] A cart road now follows this line without rising above 3,300 ft. [6] DDn. 221 (183 , 18–6–26 ; cf. DDn. 230, M 414, 1–10–26. [7] quoted in *As J.* Nov. 1826 (594). [8] MRIO. 174 (1).

No reliable surveys of the harbours were available, though Court [II, 391–2 ; III, 17] and his assistant Criddle had been on survey in the Mergui Archipelago between 1818 and 1820[1]. The old chart, which has an entry about latitude 10°—"on 16th August saw great fishes running out from amongst the islands" of Macartney's Bay—was too far south.

In 1824 therefore, after the occupation, Robert Moresby surveyed the Tavoy River, and in 1876 his survey, published by Horsburgh in 1827, was found "far superior to that issued by the Admiralty"[2]. The Moulmein River was surveyed from Amherst to Martaban, with soundings and sailing directions, by Frederick Abbott of the Engineers, the second of a distinguished family of five brothers[3], but a chart by "Mr. Adam" was found by Grant to be "very inaccurate ; neither the channels nor soundings are correct"[4] [184]. The Amherst harbour was resurveyed later by Bowman and Spiers[5] [pl. 8].

During July and August 1826, Laughton and Hutton, "of the Hon'ble Company's flotilla", worked their way from Rangoon to Martaban by inland creeks, the passage taking 28 days[6].

The first land surveys of Tenasserim were made out by James Low, Madras Infantry, who had complied a map of Siam as early as 1822 [80]. He was attached to the mission led by Lt Col. Snow in September 1824 and continued survey after its departure[7] till October 1825. His surveys included a "plan of the fortified town of Tavai"[8] and a route

to the Siamese frontier. ... Met no Siamese. ... I had the honour to hoist the British flag on the summit of the mountainous ridge along which the line mutually bounding Siam and Tavoy lies, and to salute it with 3 volleys of musquetry from a havildar's party. ... Left an account of the visit sealed up in a bottle, 20th February 1825[9].

He then surveyed a route northwards through Ye to Martaban[10], and in May 1825 surveyed up the Salween beyond "Yoonzalen Kyaung"[11]. He made a large scale plan of the "town and stockade of Martaban", beautifully drawn, and a "sketch of the country round Moulmyne"[12] ; the towns of Amherst and Moulmein not existing [75 n.2 ; pl. 8]. From these journeys, and "native charts procured in the province" he compiled a "plan of the Burman province of Mautama or Martaban"[13], whilst his "plan of the province of Tavai", a somewhat elementary sketch, was lithographed in London by John Walker[14].

After the signing of the treaty of Yandabo [70],

Mr. Crawfurd, one of the Commissioners for Ava and Pegu, proceeded from Rangoon to Martaban in the end of March [1826] to take possession of the districts of Martaban and Ye, ceded to us by the late treaty, as well as...founding a new town for the capital...[owing to] the restoration of Martaban itself, which is on the west bank of the river, to the Burmans [70 n.8]. ... Captain Hammond[15], having measured the ground with the perambulator...along the smooth sandy beach, drew out a plan of the whole ground[16]. ...

They explored the river up to Moulmein and Martaban and took soundings ; "until our visit the existence of a tolerable harbour had not been suspected". On 6th April the new capital was named Amherst, after the Governor General[17].

Grant had now no justification for continuing survey in Ava and Pegu ;

The war having terminated, there still remained a few weeks available for astronomical observations. Several objects presented themselves ;—1st. A survey of the Irrawady to its junction with the ocean—2nd. The determination of the longitude and latitude of Pegu—3rd. A voyage to Martaban to determine its geographical position.

The first, though recommended by the naval Commander-in-Chief, I had not the means of executing, nor was it in the exact line of my duty. ... Boats could not be spared and, had

[1] Marine Bd., 11–11–18 ; DDn. 133 (345). [2] MRIO. 176 (1) ; Markham (52). [3] MRIO. 176 (9), sd. Dec. 1824, received in SGO. 22–1–25 ; DDn. 265 (208), 17–6–31. [4] DDn. 240, M 420. [5] MRIO. 100 (2, 3). [6] ib. 104 (32) ; 156 (68). [7] HMS. 667 (793), 12–12–25. [8] Plan of Tavoy Fort, 1824, by Arthur Cotton, Mad Engrs., *Ben Regr.* 484 (82). [9] HMS. 665 (946). [10] MRIO. 191 (22–3). [11] Yunzalin R. 17° 18′ 42″ N., *ky* pronounced *ch.* [12] MRIO. 191 (7, 8). [13] ib. 154 (14), scale 8 m. to inch, sd. Penang, 1–12–25. [14] HMS. 678. [15] QMG.'s dept., Madras. [16] *Govt Gaz.* 30–5–26 (672, 677). [17] Crawfurd, II (81–8).

I gone on the Irrawady, the season for astronomical observations must have passed away before I could reach Martaban. I pressed the Commander of the Forces for boats to convey me to Pegu, but he stated he had none to give, though he seemed anxious I should go [73]. The Commander of the Forces soon after embarking for Calcutta, I was left at liberty to prosecute my own plans. ...

At the advice of the Civil Commissioner[1], I decided to proceed along the coast to the mouth of the Sittang River, in order to ascertain the practicability of its channel to proceed up to the town of Sittang. ... Eventually a brig and rowing boat were obtained. ... It was not till the 13th April 1826 that I was enabled to leave Rangoon.

I wished to penetrate into the Sittang River by keeping as near the Pegu shore as possible, but, after ascending as high as latitude 16° 42′ (determined by meridian altitudes of the sun) and longitude 90° 45′, this was found to be impracticable, as nothing was to be seen but extensive shoals and breakers. Edging along the eastern shoals which obstructed our entrance... I again descended to 16° 20′, and keeping the shoals on the west I with much difficulty reached latitude 17°. ...

Very strong tidal bore. The master of the brig and myself resolved, as soon as the impetuosity of the tide should somewhat abate, to proceed in a row boat as far up the river as our soundings would allow. We accordingly proceeded about 20 miles in a N.W. direction, where we found ourselves surrounded by shoals and breakers. It is unnecessary to dwell on the perils we encountered in quitting the channel. ... On the 21st, full moon, the tide drove with such velocity that the row boat parted cable, ... and I expected every moment the brig would part from her cable or founder.

We did not reach Amherst[2] till the 24th of April, having 38 souls on board, and scarcely a drop of fresh water.

The survey enables me to submit the following information ;

1st. In the maps hitherto constructed, the coast extent from Elephant Point in the Rangoon River to the island in the mouth of the Sittang has been laid down too far to the south from 10′ to 15′.

2nd. In Horsburgh's maps, ... Pagoda Point at Amherst on the Martaban coast has been laid down too far west by about 10′, while in one or two constructed more recently, probably grounded on chronometers, it is laid down too much to the east.

3rd. Vessels drawing 6 feet cannot go up by the western channel to the town of Sittang.

On 15th May, 1826, Grant wrote to the Surveyor General from Amherst ;

I have completed a survey of the coast between Rangoon and Amherst, in the course of which the brig and row boat placed at my disposal had nearly perished with every soul, owing to the violence of the current in the entrance of the Sittang River, which drove us among the sands, and had the weather been less moderate I must inevitably have perished. The row boat parted, and on our arrival here we found her a wreck in the northern channel. ...

I have corrected the whole of the northern and eastern coast. ... I have also made a survey of the Salween River as far as latitude 17° 13′, being unable to proceed higher up by reason of the monsoon. ... I returned to this place on the 12th instant, and now avail [myself of] the first ship to convey me to Rangoon (the brig being disabled)[3].

Of the trip up the Salween he writes ;

I proceeded in the brig as far as Trokla, where the tide ceases ; then I proceeded in a canoe as far as the rapids, a distance of perhaps 25 miles, having been three days pulling up between the two places. I endeavoured to push on against the advice of the people and the chief of Trokla, but when I reached the rapids I saw it would be impracticable to pass them without the most imminent risk of swamping the boat among the numerous rocks...and, the interpreter having declared the boat would go no further, I judged it prudent to retrace my steps, seeing, moreover, that had I been able to pass the rapids, I could have only estimated distances, and could not have reached the bifurcation of the Salween and the Yambiayu Rivers in less than three days, and the danger of coming down among the rapids at this season was still greater than that of going up. ...

I carried the survey as far as Miang, about 20 miles from the extreme of our frontier and, though for 7 or 8 miles...estimating the distance, I am well satisfied the error does not exceed 2 miles out of the 50[4]. ...

On reaching Amherst town my first object was to construct a small observatory for the transit instrument. Having left the large astronomical circle at Rangoon, I had no instrument

[1] John Crawfurd. [2] Amherst town, 94 H/12, 30 m. S. of Moulmein. [3] DDn. 221 (180–2).
[4] Possibly MRIO. 157 (63), map of "Thanlueen or Salowen R." as high as "Troufla" ; without date or surveyor's name ; might be Low's [74].

for observing the altitude of terrestial objects, but the mountains...were visible above the horizon of the harbour, and I observed their angles of elevation with the sextant. Much dependence however is not to be placed on these heights ; the distance was too great and the accuracy of the angles of altitude uncertain[1].

Having fixed the latitude and longitude of Amherst [74], and the monsoon putting a stop to further survey, Grant returned to Calcutta where he spent the rains in arranging his materials.

In September 1826 Government sanctioned a survey of Martaban province, but directed that Grant should confine himself to the interior, leaving the coast to the marine survey. He returned to Amherst in January 1827. After observing latitude and longitude, he sailed to Moulmein, fixed the latitude, and made another boat journey up the Salween. Leaving Moulmein on 28th, he reached Trokla ;

Since I was here in May 1826, the village has been removed about ½ a mile to the southward in consequence of tigers having entered the village and carried off two or three persons.

He then went on up the river to Kokret, within 6 furlongs of Yunzalin creek, [74 n.11], having observed latitude at eight stations ;

The positions thus determined will...enable me next month to complete the triangulation of the river, as far at least as our territory extends northward, an object which I should have accomplished on the present occasion had not an equally important object been in view. I allude to the survey of the Attaran [pl. 8], and the determination of the position of the pass of the Three Pagodas, which leads into the Siamese territory, distant about 130 miles.

The advanced state of the season left me no alternative but of returning forthwith, and making...preparations for proceeding on so distant a journey[2].

As it was impossible to make a good triangulation through the densely wooded hills, Grant surveyed up the Ataran by boat ;

The position of the Three Pagodas...forms almost the only tangible limit of our territory with Siam. In all former maps this point has been placed much too far to the north-east, in consequence of which the area of the province appeared nearly double what it really is. ...

The reaches of the river seldom exceeded 3 furlongs, and the only means I had of laying them down was by protracting the bearings and estimated lengths, and then at the end of every seven or eight miles a scale was formed from the distance in latitude and longitude deduced from the astronomical observations each succeeding day. ...

The features of the country are laid in from the eye. ... The jungle and grass reeds had everywhere become so thickly interwoven as to render vain all our endeavours to penetrate even a mile on either side, and the dense smoke of the jungle contracted within very narrow limits the extent of our prospect [32, 113, 184]. The general direction of the survey being about S.E., the chronometers were advantageously employed, and could be fully depended upon for giving accurate intersections with the observed parallels of latitude.

As...the survey would occupy...at least 30 days, it was necessary to carry provisions sufficient to supply the followers, etc., for that period. Five canoes and 25 boatmen were accordingly employed.

Lieut. Scott of the Madras N.I.[3] had been deputed in January to survey the overland route. His was not professionally a surveyor, but his zeal and persevering spirit deserve the highest commendation. His survey unavoidably partakes of the errors incident to a perambulator measurement, but it may be easily corrected from the data here given.

Grant was now given the assistance of De Montmorency, who ran a perambulator traverse along the 40 mile track from the head of the Ataran to the Three Pagodas[4]. Along the river "the jungle was so thick that it was...impossible to run the perambulator ¼ of a mile, or to measure a base in any direction, and the water in the creek is so shallow at this season...up the lesser creeks[5]".

They returned to Moulmein on 15th March 1827, and Grant now made a third expedition up the Salween, and carrying triangulation to a distance of 75 miles in a direct line, connecting with his previous stations[6] and fixing prominent peaks. He returned to Moulmein on 18th April, to take up the survey of the Gyaing river, [pl. 8].

[1] Journal, DDn. 239, M 421. [2] to SG. ; DDn. 221 (211), 10-2-27. [3] really David Scotland [q.v.]. [4] MRIO. 157 (5). [5] DDn. 240. [6] Reaching latitude 17° 32′. This may be MRIO. 176 (4) ; Salween R. from "Moulmyne to the Kurene Territory" ; shows "Taumeeaup", 17° 30′.

I had not proceeded further than the junction of the Houndroo with the Gayen, when the monsoon burst forth with tremendous violence, and so unexpectedly that I had not made the slightest preparation. ...

The several surveys thus executed embraced a period of 115 days, of which 75 were occupied in outdoor duty. The survey could not be resumed till the month of November, the country being almost entirely under water, and extremely unhealthy[1].

He spent the rains at Moulmein, and suffered so much from malaria that when the weather cleared he had to leave all field work to De Montmorency[2], who started on October 1st with the remeasurement of the base at Moulmein, and the determination of distance between the Moulmein and Martaban pagodas[3]. He moved up the Gyaing river on the 19th,

estimating the lengths of the reaches and taking magnetic bearings, this being the only way this river can be surveyed, till it can be corrected by some azimuth intersections hereafter.

12th November. Arrive at 2nd Kareene village, about one mile inland on the left bank of the river, which was here so very rapid that I had to give up the large boats, and proceed in one small one. Even with 9 rowers had much difficulty in making way against the rapid stream. ...

13th. Employed in taking bearings, &c., of the reaches. River gets very narrow, about 70 feet broad, very rapid, and the banks high and rocky. Go on this day till the river is so rapid as to prevent my proceeding any further. From information estimate about another 15 miles to source[4].

He returned to Moulmein on 17th November, and on 30th Grant issued his last instructions before returning to Calcutta ;

There are three distinct portions of territory open for perambulatory survey. ...

1. The country between the Salween and the Gayen rivers extending up to the foot of the hills. This object will be best effected by making several sections across the country.

2. The country between the Attaran on the east and southern channel and the Wagroo creek on the west...will comprehend an accurate delimitation of the range of hills commencing at Moulmyne. This object will likewise be best effected by running the perambulator up to the foot of the hills wherever practicable. ...

3. A sketch of Pulo Glocoour with an accurate outline of the ridges of hills and also the position of the villages. ...

You must depend on your personal exertions. A man of active spirit will not be retarded in his course by trifling inconveniences or obstacles[5].

On arrival at Calcutta he reported that De Montmorency and all his party had suffered from "severe attacks of fever and ague" during their survey up the Gyaing and that he had despatched a fresh set of lascars from Calcutta[6].

De Montmorency was unable to complete all the tasks left him for he was called to Upper Burma at the beginning of 1828, and did not return to Moulmein till the rains [78]. Grant took a sea voyage to China but died before reaching Singapore. Early in April 1828, therefore, the survey was officially closed ;

It is doubtless very desirable to have an accurate and scientific survey of our new possessions on the Tenasserim coast, but the object is not one of such indispensible necessity as to justify a farther outlay of...public money...in the present state of our finances. Government resolves accordingly that the Martaban survey shall cease from the present date[7].

Amongst his numerous maps and sketches[8] Grant left a

map of the conquered provinces of Martaban, Ye, Tavoy, and Mergui. Reduced and corrected by Captain P. Grant. The southern parts of Martaban and Ye are taken from Captain Low's survey, and Tavoy and Mergui from a map furnished by Mr. Maingy[9]. The Pegu and Martaban coasts, also the Salween River, are laid down from Captn. Grant's survey. Scale 1 inch to 8 miles[10].

A survey from the Three Pagodas to Kamburi in Siam was made in April and May 1827 by James Leslie of the 134th Madras Infantry, deputed to carry letters to Bankok from Sir Archibald Campbell commanding at Moulmein[11].

1 Maps MRIO. 176 (10–7) show triangulation by De Montmorency. 2 MRIO. 157 (61, 64). 3 Large scale survey of Moulmein, MRIO. 191 (9). 4 Journal, MRIO. M 426. 5 DDn. 220 (307). 6 ib. (303), 1–1–28. 7 DDn. 219 (242); BSC. 11–4–28 (13). 8 MRIO. 154 (15–7) 157 (5, 6, 10, 63, 64). 9 Anthony De la Combe Maingy : PWI. CS, 1812 ; Magte. at Moulmein. 10 MRIO. 157 (6), SGO. copy ; *IO Cat.* (306, 309). 11 MRIO. 90 (27) ; 91 (32–5) ; DDn. 219 (225), 17–4–27.

MAPS & GENERAL SURVEYS, 1824–8

In March 1826 Dr. John Crawfurd, who had held many political appointments in the far east [II, 380 n.10], was appointed Civil Commissioner of Pegu[1], with headquarters at Rangoon, pending a final settlement with the Court of Ava. Charles Alves, of Madras Infantry [II, 376], in civil charge of Bassein, and an experienced surveyor, compiled a map of the Irrawaddy Delta[2], described as

a sketch exhibiting the disemboguement of the Irrawaddie, with the various channels of water communication between Rangoon, Bassein, and the upper country. This has been compiled chiefly from information, carefully collected however, and...a more correct map of the delta than any we have before been possessed of. ... It was only commenced subsequently to a communication from Mr. Commissioner Crawfurd, requesting I should obtain as much oral information...as possible. ...

The only ports which can be safely made from the sea are Rangoon and Negrais. The other mouths of the Irrawaddie can be approached only with much difficulty and in fine weather, and are not navigable for large vessels to any distance[3].

Another survey of the delta waterways made during the occupation was a

chart shewing the route pursued by boats from Bassein to Rangoon by the rivers ; compiled from observations by Robert Moresby, 1st Lieut. Hon'ble Company's cruisor Mercury.

N.B. A good and well-regulated chronometer used to find the longitudes—The latitude by the sun at noon day—The direction of the river by azimuth compass bearings—and estimated distances corroborated by lat. and long. Scale about 1 inch to 2 miles[4].

"The Rangoon River, sand & reach", with chart and sailing directions from the sea, was surveyed during 1824 by M. F. Smith, a ship's captain[5] of Chittagong.

In September 1826 Crawfurd was deputed on a mission to Ava, which resulted in the signing of a commercial treaty[6] under which he remained at Ava in the capacity of Envoy. He took De Montmorency with him, and put him to survey

the town & fortification of Ava, as well of its environs, accompanied by a short descriptive memoir. ... prepared...under circumstances of much difficulty. ... The delicate circumstances under which the mission was placed proved an insurmountable obstacle to my availing myself more extensively of his useful and able services[7].

Ava lay at the junction of the Myitnge River with the Irrawaddy, 12 miles below the present city of Mandalay. The survey was on scale 400 yards to an inch, and covered an area of about five miles to east, west, and south of the city[8].

Early in 1828 De Montmorency was deputed from Moulmein [77] to survey the Chindwin River "from its conflux with the Irrawaddy, north to the stockade (or *kin-tat*) of Nat Kyun Aung Myai"[9]. His journey with a "fleet of boats" took 21 days up the river, and his survey helped Pemberton in settling the Manipur boundary [66]. The Surveyor General writes in July ;

Mr. Montmorency has returned to Moulmeyne. He went from Umrapoora up the Kyan Duan, or Ningthee river (which falls into the Irrawuddee) to Gendah, where Lieut. Pemberton, our Munipoor surveyor, met him. This completes a line from the mouth of the Irrawuddi through Munipoor and Sylhet to the Burrampooter[10].

To meet De Montmorency, Pemberton surveyed through "the Kumbub (Kubo or Kabaw) valley" claimed both by the Burmese and the Manipuris [65–6][11]. He found some uncertainty as to the correct name of the river ;

Sir A. Campbell...expresses astonishment that in no part of its course is the name Ningthee given to the Kyen-duen up which Lieut. Montmorency proceeded. This river...is called Ningthee Tooral, or "the beautiful river", by the Munypoories, who know it by no other name ; by the Shans or Kubos, the original inhabitants of that valley, the Ningthee is called Num tarong, or "water descending", so that we have no less than four names for the same river—By Burmans, called Khyen Hwen, or Kyen-duen, and Thanba wattee—Shans or Kubos, Num

[1] there being a military and a naval commissioner as well. [2] MRIO. 174 (7), Alves also surveyed route from Padoung to Toungup Pass. [3] DDn. 219 (6), 14–8–26 ; HMS. 669 (175). [4] MRIO. 174 (27). [5] ib. 104 (33) ; 174 (31) ; Marshall Frere Smith, mariner ; m., at Chittagong, 2–11–1795, and left several children ; name on these charts copied as M. F. Crisp. [6] dated 23rd Nov. 1826. [7] from Crawfurd, 7–2–27, DDn. 219 (46) ; HMS. 671 (213). [8] Map, HMS. 678, and pub. in Crawfurd. [9] Kindat, lat. 23° 45′ N. ; Map, MRIO. 175 (22), 7–27, March 1828 ; *IO Cat.* (120) . [10] DDn. 231 (156), 8–7–26 ; 219 (249), 16–8–28. [11] Map, MRIO. 156 (21–4).

Tarong—Munypoorees, Ningthee—and the river marked Ningthee in the lithographic map is the Khyenduen, or Thanbawattee, on the eastern side of the Ungoching Hills, and no other[1].

In December 1826 Crawfurd was relieved at Ava by Henry Burney, and published later his *Journal of an Embassy...to the Court of Ava* with a map

compiled by Mr. John Walker, of the Admiralty, a gentleman skilled in every branch of eastern geography ; and, as the author had no share in its execution, he may say without vanity that it will be found to exhibit the best view of Burman geography which has been offered to the public. The following is a brief account of the documents from which the map...has been compiled.

The river Irrawadi is delineated from the survey of Colonel Thomas Wood, with a few corrections by the late Captain Grant. The survey of Colonel Wood, although executed above thirty years ago, ... is still, and after several more recent ones, the best extant, a sufficient proof of the skill and accuracy with which it was originally executed[2] [I, 85].

The country forming the delta of the Irrawady, from Bassein to Rangoon, is taken from a sketch by Captain Alves [78]. The Salween River and the Province of Martaban generally are taken from the surveys of Captain Grant [75–7].

Much of the interior of Burman Dominions is from the sketches of Dr. Francis Buchanan Hamilton, who like Colonel Wood, accompanied Colonel Symes, ... and actual enquiries have, in many cases, confirmed the geographical speculations of these gentlemen [I, 84–5].

Arracan is delineated from Colonel Wood's surveys, and the sources of the Brahmapooter and Irawadi are laid down from the reports of two enterprising young officers, Lieutenants Wilcox and Burlton [55–64, pl. 7]. Cassey, or Munnipoor, is delineated from the surveys of Lieutenant Pemberton, another enterprising and intelligent officer [65–6].

The coast of Arracan is delineated from the chart of Captain Crawford, a skilful and experienced marine surveyor, well-known for his surveys of the China Seas and Straits of Malacca.

The country of Assam is taken from the surveys of Colonel Wood [I, 80–2], and that between Arracan and Bengal from those of Lieutenant Fisher [50–3].

The survey of the roads...through the district of Thalen, and...the pass of the mountains into the Arrakan, together with that of the Lain and Pegu Rivers, were executed by Captain Trant, a most intelligent and talented officer, who was actively engaged throughout the Burmese War. Captain Trant is the same gentleman whose interesting narratives of the route from the Irawadi into Arracan after the termination of hostilities, I have referred to [71][3].

Other maps of Burma and the far east were compiled at this period. We have already referred to one by Henry Burney, that was signed by him, 23rd June 1824, as Military Secretary to the Governor of Prince of Wales Island [71]. It is a large map about four feet by five, scale nearly 24 miles to an inch, covering Burma, Tenasserim, and western Siam[4]. It bears the following notes ;

The great river of Ava, Irrawaddy, was taken from Ensign Wood's chart in Syme's Embassy with some alteration. The northern portion of that river, the boundaries of Ava towards China, & other rivers and places in the Birman dominions were set down after comparing the personal knowledge of Mr. Gibson [71] & his numerous followers with the accounts published. ...

In the orthography of the names of places, Mr. Gibson, being acquainted with some little Latin, preferred...Dr. Gilchrist's excellent system [I, 249–50], writing down the words so that they might be pronounced according to the broad accent with which that language is read by the Scotch & by foreigners. ...

This map is part of a large map of the kingdoms of Ava, Siam, & Cochin China, which Capt. Henry Burney and Mr. George Gibson compiled. The latter was the first commissioner of an embassy from the Emperor of Ava to the King of Cochin China, to which the Government of Prince of Wales Island had liberally assisted him to proceed in 1823, after the vessel that was conveying the embassy had been burnt in Penang harbour. ...

The sea coasts in this map were taken from Mr. Horsburgh's latest charts, and from some French charts by D'Après de Mannevillette [I, 310] & from a manuscript chart of the coasts, islands, & rivers, between Junkslon & Negrais by Mr. Gibson himself.

The country on the east side of the Gulf of Siam was set down according to information received by Mr. Gibson whilst at Cochin China, particularly from Mons. Diard, a travelling

[1] DDn. 213 (169), Muneepoor, 10–8–28. [2] still quoted during campaign of 1852–3. [3] Crawfurd, II. (xiv, 162–3). [4] MRIO. 154 (6) [71, n.2].

naturalist from the Parisian museum of natural history, who had visited Cambodia & most parts of Cochin China[1].

The great river of Siam was taken from the plans in La Laubère's account of Siam[2], & 1st vol. of Kampher's History of Japan[3]. The other rivers & places in Siam were set down from the map in Laubère, and from information received & native maps seen by Mr. Gibson whilst at Enva or Ava.

Burney elsewhere records that,

having persuaded Mr. Gibson and several of his followers to attend at my house for 8 or 9 hours a day during 20 or 25 days, he and I with the assistance of 2 copying clerks succeeded in completing a large map. ... I do not pretend to possess a very accurate knowledge of the principles of map making[4].

Another map by Burney covered Tenasserim, Siam, the peninsula and straits of Malacca, and part of Sumatra, on scale two inches to a degree[5].

Several maps were copied or put together in the Surveyor General's office between 1824 and 1828[6], one of Upper Burma scale 16 inches to an inch "exhibiting lines of military approach to Umarapoora...from s.w. frontier of Muneepoor and from the coast of Arracan", with notes by Hodgson in April 1828 ;

The tracts in the vicinity of the surveyed lines may be considered as correctly laid down. The other parts of the map are constructed from the best information which could be obtained. The meridian of Muneepoor...[from] satellites of Jupiter by...Pemberton, & compared with correspondent sights taken by me in Calcutta. ... Umerapoora...from Wood. The accompanying journals of Lts. Pemberton and Trant describe the nature of the country[7].

In 1826, after the campaign was over, James Jackson compiled a map of his own, which was engraved and published by De La Combe in Calcutta. The general ignorance of the country is indicated by his placing the source of the Salween about latitude 23°, in what are now known as the Northern Shan States[8].

A map that may have been known to Burney when he was collaborating with Gibson was signed by James Low at Prince of Wales Island in March 1824. It is on scale 5 inches to a degree, very roughly drawn, but full of interesting comments and information. Besides a note on orthography and the meaning of the Siamese descriptive words, Low thus describes his compilation[9] ;

This map of Siam, Camboja, & Laos, compiled from...of original native materials & intended as an accompaniment to a geographical memoir, ... was compiled in the year 1822, and has since been enlarged. The *outline*...has been chiefly taken from D'Anville's atlas [I, 210, 331]. The latitudes and longitudes of the principal places...have been mostly laid down according to more recent geographers. ... The positions of the following places are thus assigned ; Menam [obviously *Bankok*], *lat.* 13° 30′ N. & long. 101° 15′ E.—Cape Liani 12° 27′ N. & L. about 101° 40′ E.—Cape Patani, 7° 4′ N. 101° 50′ E.—but the coasts of the Gulf of Siam have never been accurately surveyed.

Further east still we have a "rough sketch...of Ava, Siam, Cochin China", stretching from Arakan to Hainan, scale one inch to a degree, prepared in 1824 at Singapore by Philip Jackson of artillery, who was employed there as executive officer, and also produced a "sketch of the British settlement of Singapore, according to the treaty of the 2nd August 1824"[10].

[1] in partnership with Du Vaucel, working for Baron Cuvier [272–3]; visited Calcutta about 1818. [2] *Historical Relations of Siam*, by De La Loubère ; 2 vols., London, 1693. [3] by E. Kaempfer, 2 vols., London, 1728. [4] HMS. 663 (728), 22–10–24. [5] MRIO. 90 (14) ; SGO. copy, 1827 see also 90 (24). [6] ib. 154 (7–10). [7] MRIO. 156 (2). [8] ib. Misc. 3–O–26. [9] ib. 90 (15). [10] ib. 90 (13) ; other maps from Jackson, ib. 90 (21, 25, 28, 29).

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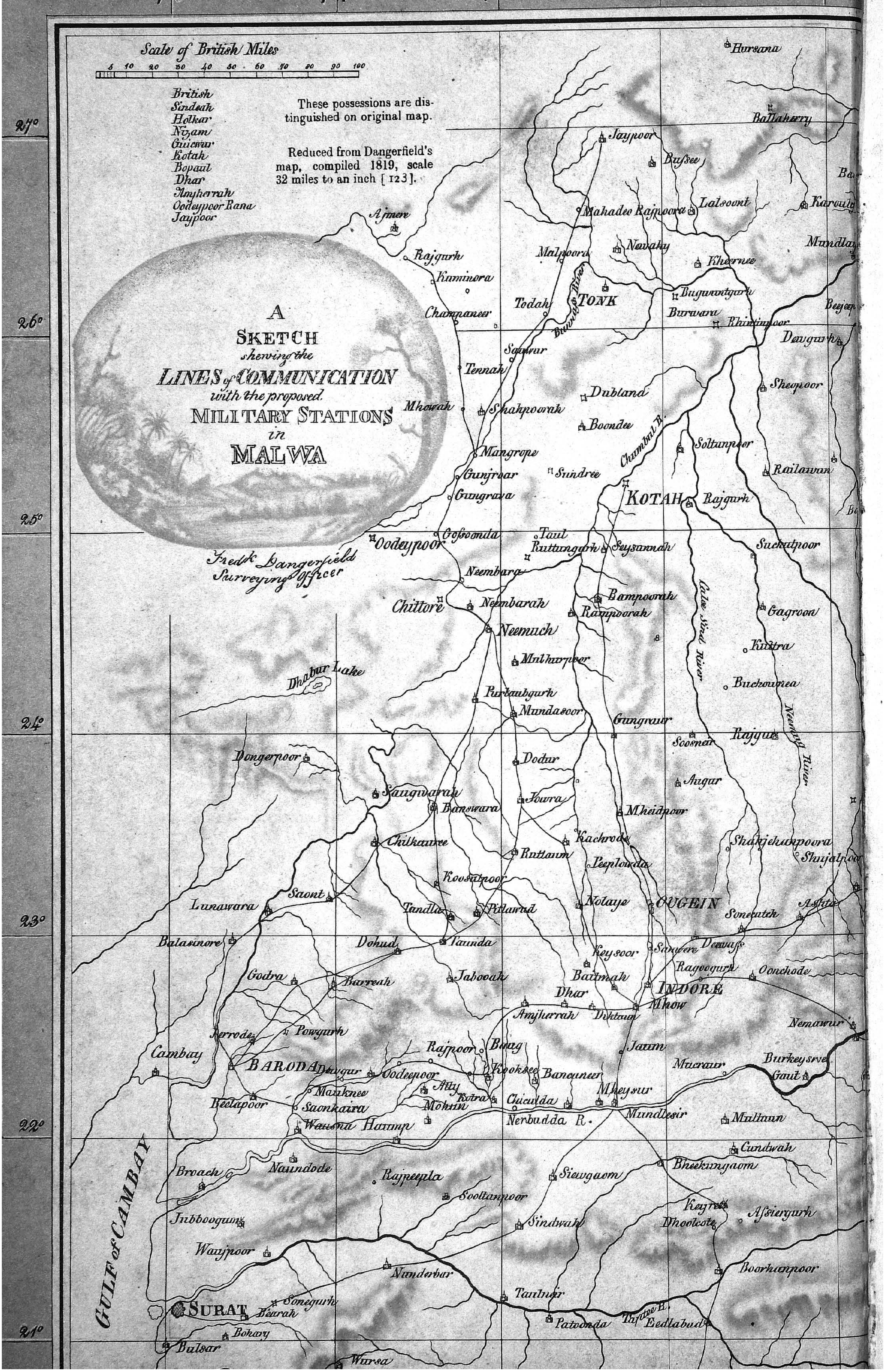
Plate 9



Scale of British Miles
5 10 20 30 40 50 60 70 80 90 100
British
Sindeah
Holkar
Nizam
Guicwar
Kotah
Bopaul
Dhar
Amjherrah
Oodeypoor Rana
Jaypoor
These possessions are distinguished on original map.
Reduced from Dangerfield's map, compiled 1819, scale 32 miles to an inch [123].
A SKETCH shewing the LINES of COMMUNICATION with the proposed MILITARY STATIONS in MALWA
Fredk Dangerfield Surveying Officer
73° 74° 75° 76° 77°
27° 26° 25° 24° 23° 22° 21°
Hursana
Ballahurry
Jaypoor
Bussee
Lalsount
Karoulee
Mahadeo Rajpoora
Ajmere
Navahy
Kheernee
Malpoora
Rajgurh
Kaminora
Buguvantgurh
Champaneer
Todah
Buneas River
TONK
Burwara
Rhintimpoor
Dougurh
Sanwur
Tennah
Dubland
Sheopoor
Mhowah
Shahpoorah
Boondee
Chumbal R.
Soltanpoor
Mangrope
Railawan
Gunjroar
Sundree
Gungrava
KOTAH
Rajgurh
Gossoonda
Taul
Ruttungurh
Seysannah
Suchutpoor
Oodeypoor
Neembara
Bampoorah
Rampoorah
Cale Sind River
Gagroon
Chittore
Neembarah
Neemuch
Kuttra
Mulhurpoor
Dhabur Lake
Buchounea
Purtaubgurh
Mundasoor
Gungraur
Soosner
Rajgur
Neewuj River
Dongerpoor
Dodur
Augar
Saugwarah
Banswara
Jowra
Mheidpoor
Chilkauree
Kachrode
Shahjehanpoora
Ruttaum
Shujalpoor
Peeplowda
Koosulpoor
Saont
Lunawara
Tandla
Pitlawad
Nolaye
OUGEIN
Soneutch
Ashta
Balasinore
Dohud
Tainda
Keysoor
Sanwere
Dewass
Ragoogurh
Godra
Barreah
Jabooah
Budnawur
Ooncbode
Dhar
INDORE
Amjhurrah
Dihtaun
Mhow
Nemawur
Jerrode
Powgurh
Cambay
Rajpoor
Baug
Jaum
Muckaur
Burkeysrve Gaut
BARODA
Dewgur
Oodeepoor
Kooksee
Banauneer
Maulnee
Ally
Mheysur
Reelapoor
Saonkaira
Kotra
Chicullda
Mundlesir
Multaun
Mohun
Wassna Haump
Nerbudda R.
Cundwah
Broach
Naundode
Siewgaom
Bheekungaom
Rajpeepla
GULF of CAMBAY
Soolanpoor
Kayreet
Assieergurh
Jubboogum
Sindwah
Dhoolcote
Waujpoor
Boorhanpoor
Nunderbar
Taulnair
Sonegurh
SURAT
Beerah
Patoonda
Taptee R.
Eedlabud
Bohary
Bulsar
Wursa

CHAPTER VI

CENTRAL INDIAN PLATEAU

Bundelkhand & Nāgpur, 1815–20 — Pindāri & Marātha Wars, 1816–9 — Quartermaster General's Officers, Bengal, 1822–30 — Central India & Rājputāna, 1819–30 — Nāgpur, 1822–31.

BEFORE describing the work of the military officers who added to knowledge of central India[1] during the war against the *pindāris* and Marāthas, we will close the account of James Franklin in Bundelkhand, and of William Lloyd in Nāgpur.

Franklin had first started in Bundelkhand in 1811, extending and filling up the surveys made by Sackville and Morrieson [II, 48–50], and in 1813 had been placed under the Political Agent to survey the territories and boundaries of those chiefs who accepted British protection [II, 51–2]. He was withdrawn for regimental duty during the Nepāl War, and after return worked with frequent interruptions till March 1820. In 1816 the Assistant Surveyor General reported that his

survey of the south-west frontier of Bundelcund, commencing at Burghur and terminating at the River Chumbul, must be now nearly completed. ... Through the whole of the above [which included Punnah, Chatterpore, and Jhansi][2] Lieutenant Franklin has carried on regular triangles. There still remain several independencies between the southern points and the frontiers of Boglecund, Berar, and Malwa ; most of these can...be traced without exciting alarm in the neighbouring powers, should Government think it necessary to complete this survey[3].

By June 1819 Franklin had completed

the survey of every independent state of Bundelcund situated between Scindiah's boundary and the Kane River, comprising in the aggregate the whole of the bowzie of Calpie, the whole of the states of Dutteah, Jansi, ... the pergunnah of Mow, and the five mahals of Bandera belonging to Scindiah, the isolated pergunnah of Aleepore belonging to Holkar. ...

All the tracts lying within these limits I have surveyed very minutely, and...neither a village, nullah, or hill worth noting, nor anything either of military or political use will be found wanting. The boundaries of states are delineated with the utmost accuracy, and all the disputed cases duly noted[4].

I have, moreover, surveyed the boundary line and a considerable portion of British territory from...Allahabad to Agra. I have also surveyed part of Punnah and of the territory of Rajah Buckt Bully. ... This tract...includes the...first range of hills from Burgurh to the Sinde River where they entirely disappear. I have delineated them very carefully, and marked every pass in them for a distance of 350 miles. In like manner I include the...Punnah range of hills for a distance of 250 miles. These are perhaps in every point of view the most interesting features in the geography of Bundelcund. They are the seats of the noted diamond and iron mines, and abound in objects well deserving the attention of scientific research.

The only independent states which remain unsurveyed by me are a part of Punnah, with the intermixed territory of Rajah Bukht Bully—...all lying east of the Cane River—which tract may be completed in two or three months. ...

This...gives...29 months, ... the period I have actually been employed in surveying a tract of 22,000 square miles, during which time I never had the slightest assistance, although the tract...is all independent territory, and the calls for address on my part, in order to get on quietly amongst their rude chieftains, are as imperious as...for mental and bodily exertion[5].

[1] Till 1947 the term Central India was officially applied to the political agency covering Mālwa, Bundelkhand, and Baghelkhand. In this chapter it is used in a wider sense. [2] Fdbks. M 335, 336. [3] to MAG. 19-9-16 ; BMC. 25-10-16. [4] Fdbk. 1819, MRIO. M 337. [5] DDn. 69 (11), 18-6-19.

He closed work in March 1820, and submitted his maps with a

memoir of a map of Bundelcund, including all the native states of that province situated between Scindiah's boundary & Boghelcund; constructed from the regular survey of Major Sackville and Captain Franklin, and the route surveys of Capts. Baily [Bayley], Strettell, Anquetil, & Franklin, which have been carefully adjusted to the trigonometrical series carried through...by Captain Franklin [200–1][1].

Though his work was not laid out with such scientific control as the surveys of Hodgson, Herbert, and Webb in the Himālaya, it was a great advance on other Bengal surveys. Waugh writes that in 1850, except for work based on the Great Trigonometrical Survey, it was "one of the best and most detailed" maps existing [II, 201][2]. It was incorporated into sheets 69 and 70 of the Atlas of India, published in 1827 [286].

Lloyd's surveys through Nāgpur were never anything more than route surveys, with descriptions of towns and villages [II, 52–3]. He continued surveying and collecting *harkara* routes until 1817, and commanded the Resident's escort till its disbandment in 1820. By 1816 he had

for some years been usefully employed in obtaining correct knowledge of all the great and cross roads within the dominions of the Berar rajah, and surveying a part of those leading to principal towns situated on his frontier. The sources of the rivers Narbudda, Soane, Wyne Gunga, Kaw-haw, and Warda[3], have been objects of his successful enquiry.

He has likewise traced the great range of mountains beginning at Amercuntuck [I, 299; III, 89], ... the hills south of the Nurbudda, and the course of that river from Mundela to Hoosungabad; and accurate measurements of the roads, with topographical delineations, have likewise been attended to.

Captain Lloyd has nearly completed a map[4] which will answer all military purposes of the Nagpur Raja's dominions, a country of which we possess little accurate information; he will then, as far as practicable, survey the provinces of Sirgoojah, Bustar, and Chattisghur[5]; the first mentioned is merely tributary to the Rajah of Berar. The roads through Bustar from Nagpoor to Chicacole, in the Circars, by the route of Byraghur, Jugdulpore, and Jeypoor [103–4], and from Jugdulpoor to Sumbalpoor, will be surveyed by natives instructed by Captain Lloyd, as the jealousy of the native chieftains will prevent his exploring the whole[6].

PINDĀRI & MARĀTHA WARS, 1816–9

Pindāris were armed freebooters from Mālwa[7], of all races and religions, who periodically gathered in mounted bands and swept through the Deccan and Berār, looting and destroying, regardless of political boundaries [1, 17].

As early as 1812 the supreme government in Bengal had been alarmed at their incursions across the south-western borders of the Company's territories [II, 44], but the urgent need for financial economy, and the trouble with Nepāl, prevented any strong measures being taken, though several representations had been made to the authorities in London.

The warding off of these raids was one of the major pre-occupations of the subsidiary forces serving the Nizām and the Peshwa at Hyderābād and Poona, and it was their particular responsibility to watch the northern passes through which the *pindāris* penetrated. For several months during 1815 a large part of the Madras Army was assembled in the Deccan to support them.

Early in 1816 a mob of more than 5,000 swept through the territories of the Nizām, and raided Guntūr and Masulipatam, committing ferocious atrocities, and escaping practically unscathed [96, 100, 408–10]. Information about this raid at length induced the home government to sanction military operations, though these had been already put in hand by the Governor General.

[1] Memoir, MRIO. M 331, 332; map in 4 sheets, 4 m. to inch, 83 (12–14) 86 (1–4), and reductions 83 (3–7, 15). [2] *PR.* (37). [3] Wainganga rises near Seoni, 55 N/12; Wardha rises near Multai, 55 K/5. [4] MRIO. 71 (31, 32); 76 (43); 188 (16). [5] Chhatisgarh covers districts of Drug, Raipur, Bilaspur, & Sambalpur, with adjacent feudatory states. [6] from ASG., BMC. 25–10–16 (63). [7] Plateau covering Indore to Saugor [I, 56 n.16]; *Imp Gaz.* XVII (100–5).

The co-operation of the Marātha chiefs, Sindhia, the Peshwa, and Nāgpur[1], was grudgingly given, and in October 1816 the main body of the Nāgpur Subsidiary Force, under Colonel Walker, occupied the south bank of the Narbada, but was out-flanked, and the *pindāris* poured into Bundelkhand and Nāgpur, and even reached the Kistna.

During 1817 the Madras army again took the field under Hislop and, with the consent of the Peshwa, the Marātha Deccan was occupied by troops under Munro. The Peshwa had, however, grown restive over other matters, and in November 1817 his troops attacked and destroyed the British residency at Poona [125 n.4], and a general war flared up. Sindhia, alone of the Marātha leaders, held firm to his engagements with the British after some hesitation.

The Bengal army, under the personal leadership of Lord Hastings[2], in his secondary role of Commander-in-Chief, had assembled at Cawnpore in September 1817. Nāgpur was occupied in December after the defeat of Appa Sahib at the battles of Sītābaldi and Nāgpur[3], Holkar was defeated at Mehidpur[4] and signed a treaty in January 1818 under which the Rājput states were freed from Marātha domination. The Peshwa surrendered in June 1818, ceding the whole of his territories with the exception of Sātāra, and being granted a pension. The war was finally brought to a close by the fall of Asirgarh[5] in April 1819 [1].

Not only did the successful termination of this war open up a vast area to survey and exploration, but a great deal of geographical knowledge was collected during its progress [I, 27, 122]. During 1815, several officers of the Hyderābād Subsidiary Force[6] had surveyed routes through Berār, and Henry Russell, Resident at Hyderābād, constantly urged the importance of detailed survey of the passes along the northern borders of the Nizām's territories. He writes to Colonel Doveton[7], in April 1816 ;

> It is indispensable to the success of any measures...adopted against the Pindarries to acquire much more accurate knowledge...of the various passes through the ranges of hills which they have to cross in their way from the Nerbudda to the southward. ...
>
> Besides a sketch of the passes, the officers should...make a report stating...—what passes are already practicable—which are not so now—and...what unfrequented ghauts can be rendered entirely impassable—... what ghauts can be stopped...by small parties of irregular infantry—... and what...will require to be defended by regular troops. ... It will also be very desirable to obtain...knowledge...of the ghauts in the advanced range of hills on the frontier, and in the direction of Boorhanpore. ... Permission might perhaps be obtained...for these passes to be surveyed, but...without exciting the alarm or jealousy of the people of the country. ...
>
> You will be pleased also to direct the different officers to obtain as much information as possible about the general geography of the country. ...
>
> A survey...is...about to be undertaken in the Paishuwah's territories, under...Lieutenant Colonel Johnson of the Bombay Engineers. The principal objects...are the range of hills to the westward of Ajunta[8]—the western ghauts by which the Pindarries might descend from the Deckan into the north of the Konkan[9], and through that into the Attaveesy [122–3, 169]—and finally, the range north of the Tapty[10].

Besides the survey which Johnson made of the passes into the Peshwa's territories [122], the Bombay Government called on Williams for a map of the passes on the eastern frontier of Gujarāt [II, pl. 15], and deputed Sutherland to survey those north of the Tapti [122–3].

In October Doveton sent in surveys and reports on the hills between Adjunta and the Warda River[11] by Stewart and Hamilton[12] that ran generally between parallels 20° to 21° and meridians 76° and 79°. In the same month Wotherspoon and Montgomerie were deputed to the southern range of *ghāts* east of the Wardha River, whilst Andrew Campbell was to survey those of the Nāgpur territories[13].

[1] The usurper, Appa Sahib, who had seized the throne in 1816. [2] Arrived India 1813, as Lord Moira, to be GG. and C-in-C. ; cr. Marquis of Hastings 1817 ; GG. till 1823. [3] 26–7 Nov. ; 16th Dec. 1817. [4] 21–12–17 ; 46 M/11, 60 m. N. of Indore. [5] surrender, 6–4–19 ; 55 C/7. [6] Poole [II, 437], Hamilton [II, 403], Strahan, etc. [II, 321]. [7] John Doveton (1768–1847) ; Mad. Cav. [338, 410]. [8] 46 P/10 ; 35 m. S. of Jalgaon & Bhusāwal. [9] coastal strip between Goa and Gujarāt. [10] DDn. 146 (8), 22–4–18 ; BSC. 18–5–16 (12). [11] About 50 m. W. of Nāgpur. [12] Reports by Bayley & Stewart, MRIO. 77 (5, 6). [13] BMC. 11–11–16.

In December Russell forwarded reports by Bayley and Stewart ;

Colonel Doveton has also employed...Lieut. Mitchell, to survey that part of the range of ghauts which lies between Adjunta and Amba[1], so as to connect Lieut. Bayley's survey with that made by Lieut. Colonel Johnson ; and at the request of Mr. Jenkins[2] he also detached ...Cornet Montgomery...and Cornet Campbell to survey the passes...in the Nagpore territory, ... but both these officers, I am sorry to say, were compelled to return to camp on account of the unhealthiness of the season[3].

Similar steps were taken by Colonel Walker, commanding the Nāgpur Subsidiary Force, who placed

a force on the Hoosainabad road [to] guard the Futtypoor and Bominee ghauts. ... An A.Q.M.G. and two officers for survey will proceed with it. ... The commissariat officers will furnish...supplies. ... The Pindaris have successfully broken through last season's cordon. ... [They] seem to be increasing in numbers and boldness every year...and, as the present system of defense has not succeeded, ... the Nerbudda should be the line of defense[4].

Several of the Nāgpur officers were on survey from October 1816, and the Resident reported in February 1817 that " Lieutenant Trueman died soon after he engaged in the survey ; Lieutenants Perry and Gibbings are still employed in that duty "[5].

On Malcolm's appointment in May 1817 as A.G.G. in Mālwa[6], he gave every encouragement to the surveyors, several of whom were employed along the Narbada River. Riddell writes from Madras in October ;

The map for Mr. Russell is nearly finished. ... I have inserted 30 or 40 miles of the Nerbudda near Huseinabad, just obtained from Lt. Gibbings. This space was surveyed on the plane table on a scale of 4 miles to the inch, and takes in the valley on each side of the river, as far as the hills. The ghauts are enumerated, and he proposes sending me a description of them. The whole shall be...forwarded to you immediately[7].

Malcolm's well-known map of Mālwa[8] [86] was published as a

Map of Central India, including Malwa and the adjoining Provinces. Constructed by order of Major General Sir J. Malcolm, G.C.B., from the routes of his division and surveys of officers under his command. From parallels 21° to 25° N., and from meridian 62½° to east of 80°. ... 20 miles to an inch. Published London, 5th April 1823, by Aaron Arrowsmith [II, 285 n.8][9].

In January 1818, the author [Malcolm] was placed by the Marquis of Hastings in military and political charge of Central India and, during the four years he filled that station, his own attention and that of the able public officers under his authority was directed to...collecting materials for the illustration of its past and present condition.

A short memoir of the map, written by Lieutenant Gibbings, A.Q.M.G., who constructed it, should have been included, but...has unfortunately been lost. ... The...map...was entirely composed from original...materials—measured routes and military surveys—corrected by the tables of latitudes and longitudes furnished by Captain Dangerfield [123][10]. ...

To the persevering ability of Lieut. Gibbings...the author feels indebted for the map which forms so essential a part of this work. ... Lieut. Mitchell, Madras Army, a very intelligent and qualified officer, was also employed in aiding Lieut Gibbings ; and also Lieut. Matthias, Madras Army, who amongst other surveys[11] completed that of the lower part of the Nerbudda, following the course of that river in every part where it was possible to remain on its bank, or sail on its stream [123].

Capt. Simes[12]...and Lieut. Hansard, Madras Army, two meritorious officers who had preceded Lieut. Matthias in this attempt, fell a sacrifice to the insalubrious climate and the fatigue to which they were exposed, but left useful surveys and observations. ... Several others, among whom were Lieuts. Irvine...and Johnston, ... contributed routes and surveys[13].

Nicholas Syme has left a vivid account of his journey down the Narbada during May 1819 between Handia and Mandleshwar[14], He received the following instructions from Gibbings ;

The General wishes you to come up here [Mhow], & we will settle everything regarding your proposed expedition. ... He does not think any person going along the banks of the

[1] 56 B/6. [2] Resident at Nāgpur [3, 90], 1810–27 ; *DNB*. [3] DDn. 146 (15), 31-12-16. [4] Memo. on plan of defence of the frontier ; MRIO. M 21 ; 10 & 14–2–17. [5] DDn. 142 (69), 28–2–17 ; B Pol C. 7–3–17 ; rough sketches Perry & Gibbings, MRIO. 72 (21–6). [6] with hdqrs. at Mhow. [7] to SG., 15–10–17, DDn. 151 (64–70). [8] see field svys. MRIO. 161 (8–10, 12, 17) ; 188 (35) ; Fdbks. ib. M 344, 401. [9] Malcolm, I (frontispiece). [10] ib., I (viii). [11] MRIO. 187 (36). [12] Journal DDn. 161 ; M 228. [13] ib. (310) ; Maps, MRIO. 81 (6, 27–30, 40–2). [14] 55 B/15 ; 46 N/12.

river can judge sufficiently as to the practicability...of boats sailing down it. ... Bring your baggage with you, & a guard of a havildar & twelve sepoys. Let them be strong active men. ...

Small dongas...will be perfectly sufficient for all the purposes he requires, viz., to bring grain from the eastward where it is extremely cheap. ...

Sir John desires ;—keep a regular journal—nature of river—country—villages—boats—villages to be re-peopled—soundings. ... In short you must mention everything. The General's object—to combine the attempt of sailing down the river with a general survey of its course and the country near it[1].

Syme started on the morning of 18th from a village opposite to Handia, with "two of the Company's boats" ;

Numerous islands—no channel deep enough to pass—obliged to return. ... With assistance from the local headman, and many small dongas and men to help, forced...way thro' the rapids with greatest difficulty and danger. ...

Sitting on the bottom of a little vessel, not daring to move for fear of upsetting it ; soaking my legs, and half of my body in water, I lost patience, & in spite of the entreaties of the boat people...about tygers, I was near taking up my abode on one of the islands for the night. I at last yielded to the boat people's request, and we made the best progress we could through the gloomy narrow channels, with the branches of trees nearly meeting over our heads, and arrived at Jogee Ghur at eleven o'clock at night, having been eight hours going through as many miles. I found almost everything in my trunk had got wet, but I was too glad to get a country cot and a little grass spread on it to trouble myself about these matters.

His servant joined him by road from Handia, about 16 miles. Leaving the boats next day to work through the channels between the wooded and rocky islands, he found his way down by land

to Poonghaut which was yet five miles distant. I proceeded through the jungle, and saw a cheetal and some red deer[2]. ... I arrived at Poonghaut at half-past seven o'clock, and my baggage which came by an inland route made its appearance half an hour afterwards. I felt very anxious about the people in the boat, who did not arrive...till...12 o'clock on the 20th. They had got within three miles...when they found it impossible from the rocky nature of the bed of the river to make further progress, and slept on one of the islands.

20th May. Halted Poonghaut. ... Sent people to try and carry a couple of small boats below the falls, but they failed, assuring me before they made the attempt that it was impracticable.

21st. The fall is twelve or fourteen feet. Having provided boats to meet me at Pantkaira, I embarked on two tied together, and went down the river which is very narrow and rocky, with deep pools and rapids, passable with difficulty. ... Arrived Palassy 2 P.M.

22nd. Having met with an accident yesterday, this morning...by land to Munassa—... pain of my foot—carried on a country cot—arrived at Panassa at 11 o'clock on 23rd—rockiness in bed of river, and lack of water. Rapids from Dharee to Sylaunee with little exception. ... These rapids have always a rocky bed over which the water rushes with considerable velocity—six or seven miles an hour—great exertion to force a boat up a current of this kind.

24th May. From Dharee to Sylaunee, in boats sent up from Sylaunee.

25th. Sylonee to Mandattah ; two rapids. Dharee to Mundleysir, passage fairly easy, and open to navigation.

Here Syme died exactly six weeks later.

Another Madras officer who contributed was St. John Blacker, younger brother to Valentine, Quartermaster General of the Madras army. He was 2nd Assistant to the Resident with Sindhia, and commanded a contingent of 2,000 cavalry which that chief placed at the service of the Commander-in-Chief. The surveys he collected, or made himself, were generally of "parts of the country which appeared least known and were blank in the latest maps" [287][3].

Malcolm further writes of his map ;

Much has been accomplished ; ... but...in a great measure either during a state of actual hostility, or by officers who were charged...at the same time with either military or political duties, and without...the instruments necessary for greatest perfection.

Several extensive triangles, however, and a large proportion of the principal roads and places have been surveyed. ... Though few places have...[been] fixed, or their position

[1] Mhow, 4 & 11–5–19. [2] *chital* and *sambhar*. [3] DDn. 144 (377), 12–10–19, MRIO. 81 (18, 19).

corrected, by astronomical observations, yet three surveys (by as many officers) having been carried on nearly at the same period, whose routes often intersected each other, a satisfactory degree of accuracy was thus obtained. ...

A great deal more...remains to be done, such as completing the areas of the triangles, filling up the intermediate blanks between the several large surveyed roads, and connecting the course of the principal rivers and their tributaries. For completing this work I desire to establish, by observation of the celestial bodies, the latitude and longitude of the principal places...from which to adjust the whole survey. Several countries...remain yet uninvestigated. I allude particularly to the boundaries of Malwa, and those extensive hilly tracts, or ghauts, which separate it on all sides from it's neighbours, ... and the whole course of the Nurbuddah through this province. ...

In the great extent of the continent and peninsula of India, no province has till lately been so totally unknown to Europeans, and none perhaps has excited greater interest, than Malwa. It was thirty years ago a blank in our best maps and, though it has been considerably elucidated by the geographical investigations of Major General Reynolds [I, 126, 217–9], ... still his means were very limited and, in fact, the obstacles he had to contend with were so great that I am less astonished at his numerous errors and deficiencies, than at the great quantity of materials and degree of accuracy he obtained.

Before we entered the province, Captain Tod had laboured with both zeal and talent to illustrate it's geography [II, 55–6], but his opportunities were also limited by difficulties that armies could alone overcome. ...

I am not a scientific man myself, but I know enough to be very alive to the importance of promoting science by every research within our power. ... It is a duty we owe Europe, and should be performed as well as attention to other principles (never forgetting the necessity of economy) will admit[1].

The map was completed in 1821 in eight sheets, 4 miles to the inch, with an index to place-names, and sent to London for publication on reduced scale [84][2].

The surveys made in 1818 by John Forbes Paton [II, 436], of the "routes of a detachment under the command of Maj General Brown, in pursuit of pindaries" are remarkable for the coloured sketches of forts and strongholds by which they are decorated [pl. 2][3].

Valentine Blacker, who was on field service as Quartermaster General throughout the war, compiled a detailed history of it, illustrated by maps for which he was greatly indebted to the extra labours of all the officers of the Q.M.G.'s department. The maps which accompany this work are...superior to any that have ever been published respecting Central India. For their construction from a mass of detached materials he is indebted to the intelligent and diligent aid derived from Capt. T. P. Ball, A.Q.M.G.[4].

These comprised 8 maps and 30 plans, compiled by Thomas Ball [II, 320], and fair drawn by James Blechynden in Calcutta. They were "all engraved under the inspection of Mr. Arrowsmith in London", on scales from 20 to 60 miles to an inch ; very clear and full of detail ; most of them in a special volume. A brief description of this notable collection is given in a later chapter [282 ; pl. 20 n.][5].

QUARTERMASTER GENERAL'S OFFICERS, BENGAL, 1822–30

From 1817 the Quartermaster General of the Bengal army was allowed a cadre of officers for survey of roads and communications, and other departmental duties. When specially required, these officers might be placed on regular surveys under the orders of the Surveyor General, but otherwise their surveys were only passed to him for mapping purposes after the Quartermaster General had abstracted all information needed for military purposes [3, 302].

In 1821, Hodgson, who had succeeded as Surveyor General, proposed that these officers should extend their operations south and west of the Company's boundaries ; each pair of officers being allotted a definite section of about 100 miles square [201]. In pursuance, and in extension, of this policy, several officers were sent

[1] DDn. 145 (1–13), 25–11–19. [3] 8 rough ms. sheets by Robert Gibbings, MRIO. Misc. 2–0–18.
[2] MRIO. 81 (52–4). [4] Blacker [14]. [5] Originals, MRIO. 97 B (1–13).

out during the next few years[1]. Alexander Gerard surveyed an area southwards from Agra—Sandys and Hall, the Jaipur area[2]—Becher and Robb made similar surveys between Allahābād, Jubbulpore, Nāgpur, and Saugor[3]—William Garden surveyed passes over the Vindhya Hills—and Hugh Morrieson the country between Nimach and Kotah[4] [335–7].

Other surveys include one by Bellew "of the route of Lt Colonel Lockett, Agent to the Governor General, from Ajmere to Jessulmeer, thence through Sirohi back to Jesselmeer"[5]—another by John Neufville in 1827 from Kālpi through Saugor, Nimach[6], Udaipur and Sirohi to Sind.

Many of these surveys were favourably commented upon by Everest as Surveyor General in 1832. They were not only important from a military point of view, but were appreciated by civil officers. In 1826 the A.G.G. at Jubbulpore asked for copies of

all the surveys of roads in the Saugor and Nerbudda Territories. ... Many road surveys have ...been made in the Quarter Master General's and survey departments, copies of which would be of infinite service to me at present, and would prevent much unnecessary delay and trouble in determining the direction of...projected roads, the commencement of which will necessarily be retarded if we are obliged to wait for new surveys of each [27][7].

He asked for a special survey ;

Although the Jubulpoor District extends to the eastward at least one hundred miles from Jubulpoor, the map of the country in that direction is a perfect blank, and we are, as yet, *in total ignorance regarding the eastern boundary*. ... I am in hopes that Government will be pleased to allow Mr. Olliver, the officer in charge of the Trigonometrical Survey, who is at present employed in establishing a series of geographical stations eastward in the latitude of 24° north [261–4], to extend his triangles as far south as 23°, from 80° to 82° east longitude, when...there would not be much difficulty in filling up the blank[8].

On the Surveyor General's advice, no change was made in Olliver's programme, but Richard Home, then stationed at Jubbulpore, compiled a map[9] which, though "mainly from information obtained from natives", was much appreciated ;

It was to him [Home] a work of much time and labour, and formed with great care and ability out of material collected by himself, combined with such as he found available from surveys made by professional gentlemen. ... Considering the imperfect...state of all the materials available, with the exception of what were furnished by Captain Robb's professional survey, ... I have found Captain Home's map wonderfully correct and, though he is now in Europe for the recovery of his health, and made this map purely from feelings of friendship for you, when you were in charge of this district, and without any view to remuneration, Government would perhaps...be gratified to have an opportunity of rewarding labours so eminently useful[10].

Home's map was passed for comment to the Surveyor General, who recommended him for a reward of Rs. 500, calling it

a creditable performance ; it contains some new information in one part, and is more complete in others than the map of that district in this office. ... It has not been corrected by astronomical observations which would have increased it's value but, as many places in the map have been determined by the Great Trigonometrical Survey, the errors...might easily be rectified[11].

CENTRAL INDIA & RĀJPUTĀNA, 1819–30

Amongst the officers of the Quartermaster General's department working under the Surveyor General [336], James Johnstone had started on a survey of Bhopāl under the direction of the Political Agent who, in April 1819, submitted

a plan of the fort of Kareya, and a very accurate sketch of the pargannah of Bairseeah[12]. ... This part of Malwa affords a field...less explored than almost any other part of Hindostan,

[1] SG.'s letter of 21–11–21, and instructions of 21–1–22. [2] MRIO. 82 (25–6); 83 (48–9, 52); 86 (20). [3] ib. 71 (7); 72 (3, 13); 73 (21); 76 (52); 78 (47); 81 (14, 47); 84 (8, 9). [4] ib. 84 (27). [5] Sirohi, 45 D/13, 25 m. N. of Mt. Abu. DDn. 282 (284), 12–4–33. [6] Nimach, 45 L/15; map, MRIO. 84 (5). [7] DDn. 203 (47), 16–9–26. [8] DDn. 217 (126), 9–12–27; BTC. 3–1–28. [9] MRIO. 78 (30). [10] from Sleeman, PA. to AGG., 9–2–30. [11] BTC. 16–3–30. [12] Berasia, 55 E/6.

and...Lieutenant Johnston has been for some months laboriously...surveying the country, and at a very considerable expense in procuring the requisite instruments[1].

In asking the Surveyor General to give professional instructions, Government stipulated that

the survey...of Bhopaul, or other foreign countries, must depend entirely on the pleasure of their respective sovereigns. Lieutenant Johnston...will submit himself on that point to the direction of the...accredited Agents of Government in that quarter[2].

Johnstone's work which Malcolm used for his map of Mālwa [84] included "valuable communications...regarding the soil, cultivation, and inhabitants"[3]. In November 1822 the Surveyor General recommended that he should extend his survey southwards [202] ;

He regularly sent in his field books, and I have received the map of the province and a memoir. ... I have from time to time instructed Captain Johnston in the manner of executing his duty, and I consider him as a zealous and improving surveyor. ...

I think favorably of Captain Johnston's discretion, and trust that he will not give offence to the rulers of those states through which operations must be conducted, but...it may be thought expedient...to explain through the political authorities that his duty is merely of a general geographical nature[4].

In 1850 Waugh reported that Johnstone's survey was "certainly one of the best and most detailed geographical documents we possess"[5].

In 1822 Rowland Ferguson offered to survey Surguja[6], covering

the populous and powerful districts of Kooreeah, Odeypoor and Mohree[7]. This line of country consists of many romantic valleys and numerous large and beautiful rivers, with whose source and termination we are little acquainted. The survey should commence at Sirgoojah-Nuggur, proceeding in a south-westerly direction as far as Ruttunpoor[8]. ... The next object ...should be the source of that wide and remarkable river, the Hudsoo[9], which is conjectured to take its rise from...the same mountain which gives birth to the Mahanuddee and Soane Rivers.

From that point the survey should strike down in a south-easterly direction to Odeypoor, from thence to Gangpur, and from Gangpoor to that amphitheatrical valley formed by the mountains called Myn Pat[10]. These mountains are remarkable for a tableland of great beauty, and for almost every variety of soil and climate. Their height by...barometrical measurement might then be ascertained. ...

The whole survey here detailed might be finished in two or three seasons ; it would add considerably to our geographical knowledge, and would afford us an opportunity of becoming better acquainted with a people remarkable for many peculiarities of character[11].

In obtaining sanction to these proposals the Surveyor General commented that

by Captain Jackson's surveyed route we already know the direct line of communication between Cuttack and Nagpoor [27–8] ; and the officers of the Ramghur Battalion have at different times surveyed the roads between Ramghur and Sumbulpoor [II, 44]. These... are only mere lines of route, and do not tend to give that full knowledge of the countries under our influence which seems desirable.

Of the country of Sumbhulpoor we know little, and less of Sirgoojah. ... That country is remarkable for containing within it a very high, and a probably salubrious, table land called Myn Pat, and also the sources of several considerable rivers, ... a knowledge of which ...cannot fail to be of use.

The survey was completed in 1823.[12]

In January 1822 Irvine, of the Engineers, was appointed to survey "the sources of the Nerbuddah, Soane, and Taptee, rivers", which lie in the Chattisgarh plateau on the borders of Bilāspur and Rewah. Hodgson had pointed out that

the ascertainment of the heads and sources of great rivers may be deemed highly interesting. ...

The sources of the Ganges, Jumna, and other rivers, originating in the snowy mountains, have been lately explored, but we are as yet in doubt respecting the true origin of three very large and noted rivers, the Nerbuddah, Soane, and Mahanuddy [I, 30]. Hitherto political rather than physical obstacles have prevented men of science from obtaining that knowledge, but at present...no difficulties exist on the former head, and very few on the latter.

[1] DDn. 144 (187), 4–4–19. [2] ib. (413), 27–11–19, BGC. [3] DDn. 191 (275), 25–5–21. [4] DDn. 198 (134), 11–11–22. [5] Maps, MRIO. 81 (2–5 1751) 82 (7, 18) 83 (1–5). *PR.* DDn. 542 (166), 20–10–50. [6] DDn. 195 (89), 3–5–22 ; BGC. [7] Korea, 64 I ; Udaipur, 64 J/4. [8] 10 m. N. of Bilaspur, 64 J/4. [9] Hasdo R., rises 64 I/7 ; joins Mahānadi, 64 K/10. [10] Main Pat, 64 N/15 over 3,500 ft. [11] DDn. 198 (73), 22–4–22. [12] ib. (70), 26–4–22 ; Map 4 m. to an inch, MRIO. 78 (23).

According to a vulgarly received opinion...the Soane and Nerbuddah are supposed to spring from the same pool near Amercuntuc [I, 29, 30], and to take opposite courses, but this is not at all probable. I think it likely that they must originate from the opposite sides of the same ridge or table land of Amercuntuc, and as the heads of the Mahanuddee and many other streams are not far distant, it is evident that the elevation of the country must be great, and to determine it is very desirable [II, pls. 1, 24].

Suggesting that the survey should follow the Narbada as far as Hoshangābād [84] and give the correct position of Nāgpur, Hodgson "observed that the country between the parallels of the Nerbuddah and Nagpur is very wild, and a minute actual survey of the whole cannot be expected "[1].

For the survey of Agra [26-7] he proposed

that Lieut. Alexander Gerard...be employed to make a geographical survey, corrected by daily astronomical observations, of the countries comprehended by the lines drawn from Jeypour, east to Agra, from thence south by Gwalior to Nurwar, and thence west to Boondee, and from Boondee to the north to Jeypour [202].

When the outline is completed the detail will be filled up...and the height of each halting place will be determined by barometrical observations. But, before Lieut. Gerard proceeds to complete the detail of the above tract, a great service will be rendered to geography if he be ordered to proceed from Nurwar, south to Seronge and Bhopaul, and thence west to Augein[2]; from Augein...Kota, and Tonk, to Jeypour ; thus...forming an accurate skeleton map, which may be filled up by other surveyors of less experience[3].

In approving these proposals Government ordered that Gerard should come under the orders of Sir David Ochterlony [II, 62-5, 90], Resident at Indore.

He left Sabāthu in October and worked down to Agra where he stayed for two months, taking barometer and other observation at the Tāj. Starting again at the end of January, he ran his survey through Gwalior and Sironj to Bhopāl. He returned to Gwalior on the 2nd June 1824, and stayed there three months, laid up with fever [204]. Reporting on his work Hodgson stressed the importance of having such preliminary framework laid out by a surveyor of high professional skill ;

Important lines have been determined...by officers when attending armies, and some parts have been filled in from information ; but these methods require the verification of surveys carefully carried on at full leisure in times of peace, and corrected by precise astronomical observations made by officers of skill. ...

During the last season that zealous and skilful officer [Gerard] determined by very laborious, but exact, methods, the true positions of the places lying on and near the meridian line from Agra to Bopaul, ... but...soon after he had completed this...he was attacked by severe illness, the consequence of fatigue and exposure, and the department will be deprived of his valuable services as he has lately signified his intention of resigning[4].

After some months, however, on political duty under the Resident, Gerard resumed the survey and sent in

an abstract of the survey from Agra to Neemuch. ... From Agra to Jeypoor must be considered only as an approximation to the truth, as nearly as can be determined by a measured line of so great an extent in an east and west direction, and laying often through a very stony country.

From Jeypoor to Kota, being almost north and south, and the country particularly favorable for the method of latitudes and azimuths, I look upon it to be accurately determined, or at least very nearly so.

From Kota to Neemuch, by far the greater part of the way lays through a very woody and mountainous tract, where it was frequently impossible to see above two or three hundred yards on any side, and the survey may be considered as correct as it could be made in such a country, where astronomical observations were comparatively of very little use, by reason of the line being far from the meridian and the number of windings of the road very great.

The exact longitude of Seronge will be determined by Captain Everest when he arrives there in December or January [245-6] and, as it will be a matter of considerable importance to get a point as far to the westward as possible accurately fixed, ... I intend, in conjunction with Captain Everest, to fix Neemuch in this manner and, if I have leisure to visit Jeypoor or even Kota, the whole space comprehended between Agra, Jeypoor, Neemuch, and Bhopal, will be exactly known[5].

[1] DDn. 198 (1), 3-1-22. [2] Ujjain, 46 M/16. [3] DDn. 198 (93), 18-6-22. [4] ib. (131), 22-10-23 ; maps, Agra-Bhopāl, MRIO. 29 (1, 20). [5] DDn. 212 (247), 26-8-24.

From November 1824 Gerard was again employed on political duty, but when the Resident asked for an accurate survey of the Sātpura Range and the Narbada River, Blacker suggested Gerard for a task that would require preliminary triangulation, and at least two assistants[1]. By the time Gerard became available Hodgson had succeeded as Surveyor General and insisted that Mālwa and Rājputāna should take priority ;

It is certainly desirable that a correct knowledge should be obtained of the places in question, but it is more to [the point] that we should have an exact survey of the whole of Malwa and Rajpootana. ...

Captain Gerard...laid down the line from Agra to Bopaul in a manner highly creditable ...and surmounted many difficulties, which arose from the perplexing...changes in the magnetic variation, caused by the abundance of iron ore in the hills near Gwalior. ... He was, in consequence, obliged to give up all reliance on the magnetic needle, and to proceed by the difficult and laborious method of determining every portion of the line by azimuths of the pole star or sun, tracing the alignment so found by flags and the explosion of rockets [182–3, 189][2]. ...

Captain Gerard was obliged to discontinue his operations on account of ill health, but now seems to be sufficiently recovered to resume them.

Gerard was, accordingly, "appointed Surveyor in Mālwa and Rājputāna, with a staff allowance of 800 Rs. a month, and...allowed two assistants, who also are to be commissioned officers"[3]. The two officers were not forthcoming but apprentices were supplied instead. Leaving Calcutta in October 1826, he reached Fatehgarh by boat, and then made a run to Agra by palanquin *dāk* to obtain the difference of longitude by chronometer [180].

The dawk journey from Futtehgur to Agra and back, ... to find the difference of longitude by transference of time, brought on a severe return of a fever which I had almost the whole way from Calcutta to Benares, and which had troubled me every year for these last six years. I was at that time unable to return...by dawk, so I marched. When the fever left me...I...proceeded...to Khasgunge. ...

I had an attack of fever at Khasgunge which determined me to return to Agra as soon as possible, so after getting an observation for the time I returned...on the night of the 7th, having during the whole journey with little intermission been in a severe fever, which has continued to this hour[4].

He was then held up at Agra by sickness for several months and, failing to give explanations that satisfied the Surveyor General, was discharged from August 1827.

NĀGPUR, 1822–31

Under the treaty of 1818 after the defeat of the usurper Appa Sahib, the nine-year-old Raghuji III succeeded to the Nāgpur throne, and his territories[5] were administered by the British Resident till he should come of age. The area now known as Berār was transferred from Nāgpur to the Nizām [II, 133 n.1] but the revenues and the administration were assigned to the British to meet the expences of the subsidiary force. Certain districts ceded by the Peshwa and Nāgpur were transferred to the British, and administered as "The Saugor and Narbada Territories" by an Agent to the Governor General. Bastar and the Chattisghar States to the east were removed from allegiance to the Nāgpur Rāja, to be controlled by the British Resident.

In November 1819 the Resident asked for a survey of all Nāgpur territories which he said would be

more than repaid...by procuring for the several superintendents...information of the provinces under their management, of which they are now much in want. Major Agnew[6] particularly

[1] DDn. 193 (67), 25–11–24 ; 204 (155), 14–4–25 ; (212) 22–10–25. [2] ib. 204 (255), 18–8–26. [3] ib. 211 (32), 8–9–26. [4] from Tāj Mahāl, Agra, 30–4–27 ; DDn. 204 (336). [5] Comprising the districts of Chhindwāra, Nāgpur, Wardha, Chānda, Bhandhra, Bālāghāt, Bilāspur, Raipur, and Drug. These districts passed to the British on the death of Raghuji III in 1853, to form part of the Central Provinces. [6] Wm. Agnew (1778–1823), Ben. Inf., Ens. 1795. Maj. 1815.

requires a knowledge of Chuteesgurh, which is nearly a blank in all our maps. Most of the lands are still unmeasured. ...

It is, besides, ... highly desirable that there should be a survey to determine the boundaries of the Company's and Rajah's territories[1] [3].

Alexander Stewart [II, 443] was appointed in 1822 and commenced triangulation on a base measured by the late Lieutenant Colonel Lambton at Takulkhera near Ellichpoor [232 ; pl. 18], but the total want of assistance rendered it impossible for him to make any effectual progress for some time...though Lieutenants Frankland and McLeod[2], of His Majesty's service, were appointed early in 1823. ... Lieut. Frankland's delicate health did not permit him to take a part in the labour of it, and he soon went to the Cape of Good Hope on sick certificate, and Lieut. McLeod was at the Cape when appointed, and resigned shortly after his arrival at Nagpore, without having benefitted the survey by his exertions.

Lieutenant Norris[3] was also appointed, but his services were required during this season to survey the late Resident's route to the source of the Mahanuddee and Nerbudda [89].

The survey consequently cannot be said to have actually commenced till the season of 1823–24, when, the services of Lieutenants Norris [and Weston] being available, ... Captain Stewart employed himself in determining trigonometrical points[4], whilst they were occupied in completing a detail survey of the pergunnahs bordering on the Wurda[5] but, Lieut. Weston having been temporarily withdrawn...for...a perambulator survey of the northern boundary, ...the progress...did not equal the expectations of the superintendent, whose zeal for the advancement of the laborious undertaking this year cost him his life.

Stewart died at Nāgpur in May 1824 and,

on taking charge of the department, ... Lieut. Norris found that...about five thousand square miles had been surveyed trigonometrically, not more than three thousand of which was completed in detail, and that the survey of the northern boundary by Lieut. Weston had been discontinued...in the Nerbudda valley in consequence of the dangerous illness of that officer, who nearly fell a sacrifice to the insalubrity of the jungles. ... His continued delicate state of health depriving the department of his more active services during the greater part of the season 1824 & 25, he was employed by order of the Resident in taking a minute survey of the city of Nagpoor and its environs[6].

After completing his excellent map of the city in 1825, Weston rejoined the main survey which

during the two following seasons advanced with great rapidity over a most wild and difficult country and, although the late dangerous illness of the superintendent [Norris] and almost all his establishment prevented his entering the jungles so early this year as he had usually done, the result...at the end of the season will prove that no time has been lost. ...

The progress of the work would, however, have been materially advanced had the aid of a few sub-assistants qualified to undertake the plain table survey been obtained since its commencement, but every application hitherto for such aid has been proved unsuccessful[7], & Lieut. Weston has of necessity been occupied on this inferior duty. ...

The trigonometrical net[8], from its commencement at the base near Ellichpoor to the meridian of the most easterly point yet determined, ... measures 197 British miles and, from the most northern point near Garurwara to the fort of Chanda, 194 miles. It comprehends a tract of the Nagpore country of upwards of 20,000 square miles, including the entire districts of Nagpoor...below the Ghauts, and the Wein Gunga, nearly the whole of Deogurh Ballaghaut, and the greatest portion of...Chanda, where it is still in progress in a south-easterly direction. ... It is possible that stations may be determined as far south as the junction of the Wein Gunga with the Preeneeta[9].

The triangular observations would have included a much greater extent of country had not the superintendent been obliged to assist at the detail survey.

The survey which was on the one-inch scale had

for its northern boundary the great range of Ghauts which runs in an easterly direction from the Wourda to the Wein Gunga. On the west and south-west it has the Wourda, which separates it from Ellichpoor and the dominions of His Highness the Nizam, and an extensive range of hills...divides it from Chutteesgurh, and confines it on the east. In this tract is comprehended the whole district at present under the management of His Highness the Rajah. ...

[1] DDn. 145 (37), 27–11–19. [2] Frederick Wm. Frankland (1793–1878), Capt. H.M. 20th Foot 6–6–22; 8th Bart. 1849—Chas. Roderick McLeod, HM. 30th Foot, Lieut. 24–11–18. [3] writer of this report (dated 14–4–28). [4] Fdbk. DDn. 176, M 234. [5] Map, MRIO. 67 (19), 8 m. to inch. [6] Plan, 200 yards to an inch, MRIO. 188 (36); shows Sitābaldi Hill. [7] see Resdt. to SG., DDn. 213 (82), December 1825. [8] Registers of triangles, DDn. 176, M 234; 270 (87). [9] at Seoni, 56 M/14.

The survey of this most important tract of the Nagpoor territories has been completed by Lieutenants Norris and Weston, assisted by one pupil[1] (whose services till last year were of little advantage)[2].

Norris submitted the above report in April 1828, with an estimate of the amount of work completed and still remaining. Out of an area of about 65,000 square miles belonging to the Rāja, not more than 37,000 produced any revenue, of which about 20,000 was surveyed by 1828.

The survey has not yet extended beyond the country yielding revenue, nearly half of which... has been completed, but before any definite period can be named for the conclusion of the whole, it is necessary to know if the extensive zemindaries under Chanda, and those of Bustar and Karoude, etc., in Chatteesgurh...are to be included. ...

The detail survey of the entire tract of country yielding revenue on this side of Chutteesgurh will...be completed during next season, and possibly the trigonometrical observations may be extended through the Chanda zemindaries, and by Kakair[3] and...Bustar, towards Ryepoor, but, as numerous impediments are to be expected in so desert and unhealthy a region, its advancement must be considered extremely precarious. ...

As the survey has advanced, various maps have been compiled, but as no well-defined tract has been completed in detail till very lately, none of them contain the entire portion. ... A map is now in progress on a scale of four miles to an inch, and when finished will be placed at the Resident's disposal. It will comprise the whole of the detail survey west of the meridian 81° E., ... contained between the parallels 19° 45′ and 22° North, ... and will contain all the country below the ghats, and west of Chutteesgurh, from which revenue is derived.

Maps on the same scale, and in portions of one degree of latitude to one of longitude, shall be prepared for the Surveyor General's office when the Resident's copy is finished, ... but if a person could be sent from that office...much time and labour would be saved.

On the young Rāja's assumption of full power from 1st June 1830, the survey was to be closed down, European staff discharged, and instruments handed over to the Resident [90]. With his final report Norris asked for the Surveyor General's instructions...for the...satisfactory arrangement of the vast extent of geographical detail...in my possession. ...

The very little assistance I have lately had in consequence of the long absence of Mr. Weston on sick leave ; the accidental death, nearly two years ago, of the only draughtsman who had ever been attached to the department ; and the constant delicate health of the sub-assistant[4], necessarily compelled me to undertake not only the whole trigonometrical, but the greater part of the plane table, survey. ... Unless time and opportunity are allowed me to complete my calculations and compile maps, I shall have only a confused mass of geographical detail ...which...can only be arranged by me, who have had the uninterrupted management of the whole for six years.

The great importance...of a minute survey of 25,000 square miles...which had previously been little known to European authority, will, I doubt not, be a sufficient inducement for you to favour our proceedings for a few months, ... that I may be permitted to retain charge of the records...till I can present them to you in a clear and satisfactory state. ...

At least six months will be required after the 1st June to compile maps for the Court of Directors, the Government, your office, and the Resident at Nagpore. ... Mr. Weston may be associated with me ; ... his abilities as a draughtsman are first-rate. ... A lithographic copy of the whole survey will materially facilitate the preparation of the maps, ... and ensure their prompt and correct delineation, and...save infinite trouble and...expense[5].

The full material comprised 61 sections on the one-inch scale with an index map, and a set of reductions on the half-inch scale[6]. They are all beautifully drawn in colours, and some are heavily shaded [pl. 10]. The area covered roughly corresponds with the present districts of the Central Provinces, omitting areas north of parallel 22° and east of the Bāgh river and the southern stretches of the Wainganga [82, pl. 17]. It does not cover Berār, which between 1803 and 1853 formed part of the Nizām's dominions [91].

The Surveyor General, Henry Walpole, expressed satisfaction with

its various details ; ... it reflects great credit on the skill and perseverance of the two individuals

[1] not identified. [2] Report by Norris, DDn. 231 (134–44), 14–4–28. [3] Kānker, 64 H. [4] either the pupil above referred to or John Cornelius, dmn. [pl. 10 n]. [5] DDn. 264 (58–64), 1–4–30. [6] one-inch field sections, MRIO. 198, A & B ; reductions 76 (20–42) 78 (1–22).

Kupoorwarree
Biskhan
Chitree
Thaoree
Dhana
Sewnee
Koeelaree
Dubarah
Mothar
Jir Linga
Salleewarra
Gangye
Kodwarree
Chargaon
Khappa
D. ree
Sewnee
Bohona
Jhandah
Jumuneea
Dongureea
Khyree
Luhgurwah
Dhana
Kuzree
Jamboree
Karabo
C H I N D
Khappa
Khoosmelee
Kokra
Amba
The
Purturra
Sewnee
Cantonments
Lal Baug
Oosureea
Sonakhaur
Noonia
Serah Dhana
Superintendents Hous
Chindwara
Umileea
Bhodree
Burrareepoora
Gooriya
Boriya
Kola Dhanna
Butkajerree
Chundungaon
Nulla
The Chowree
Chargaonree Nuddee
Saruswarra
Mutkoolee
Soanpoor
Khairwara
Sirra
Bandabo
Sirra reet
Sirra reet

NĀGPUR TERRITORIES

Reproduced from one-inch survey carried out under Frank Norris between 1824 and 1830 [90–3]. Based on triangulation started by Alexander Stewart [II, 443] from Lambton's triangles.

Drawn by John Cornelius.

E Weston Lt.
Asst. Survey Dept.

F. B. Norris
In charge late Nagpoor Survey

Reg No 4844 HD'50–800'51

Printed at the Survey of India Offices (H L O.)

who have completed with so little assistance a minute survey of 25,000 square miles of a country, the greater part of which had been previously unexplored.

The survey is founded on a triangulation depending on Colonel Lambton's measured base at Ellichpoor. The theodolite which was employed in the primary triangles is of a superior kind, having been expressly ordered from Europe by Colonel Lambton, and was purchased for the Nagpore Survey at the sale of his effects [236].

A series of secondary points have been determined by a smaller theodolite of ordinary construction. The detail has been taken up by means of the plane-table in sections of 400 square miles, on a scale of 1 inch to a mile, and the topographical features have been well expressed.

Messieurs Norris and Weston will be required to complete a map upon a reduced scale of 4 miles to an inch, which they have already commenced; to prepare a register of their trigonometrical calculations; a descriptive memoir; and to complete and arrange the field sections and other materials[1].

Norris and Weston were allowed six months at Calcutta from August 1830, special rates of pay being fixed as they were not servants of the Company. As a special favour they were granted Rs. 400 each to cover travelling expenses from Nāgpur to Calcutta, but were allowed no pay from 6th June to 31st July. With the help of John Cornelius, who had been with the survey from the beginning, and who printed the names, "a very tedious part", the map[2] was delivered within the stipulated period, and the final records submitted on March 1831.

The Directors had some qualms about having left the Nāgpur State to bear the full expense of the survey;

A trigonometrical survey of the Nagpore Territory would no doubt have been highly beneficial if the country had continued under British management, and is even now useful, although more so to ourselves than to the Rajah. But, in making him pay the whole of the expence, we have done what would have been scarcely justifiable if we had then contemplated withdrawing, almost before the survey was completed[3].

Everest, who was now Surveyor General, and always exacted a very high standard of work, deputed Wilcox and Waugh to make a careful examination of the triangulation;

You...will jointly examine the work of Captain Stewart and Lieuts. Norris and Weston, comprising a net of triangles originating from the Takal Khera base, and closing in with my points, ... in order that the real value of those operations may be explained in as precise and clear a manner as possible for the information of the Honorable Court of Directors. ...

Trigonometrical operations...are not worthy which will not bear test; they would be accounted as totally unfit to compare with others bearing the same designation, and must sink into the lower level of comparison with route and perambulator surveys, and military reconnaissances. If, therefore, you find on examination that these operations are defective on this ground, you must then proceed to estimate their worth as affording data for geographical purposes. ...

Lastly your opinion as to the general merits of the execution of the detail, and the average rate at which it proceeded[4].

The result of this examination was thus summarized by Waugh in 1858, at the time when a revenue survey of the Central Provinces was proposed;

I mention at once the clear impression I retain of the result of the examination which was instituted by Colonel Wilcox and myself 26 years ago. We were of opinion that the topography was valuable, and highly creditable to Messrs. Norris and Weston, but the triangulation was of inferior order, imperfect, and executed by an observer ignorant of the use and adjustment of an instrument of the class which he employed.

His angle books contained evidence recorded by himself of his ignorance of geodetic instruments of that order and, such being the case, his triangulation was deemed unworthy of incorporation with the Great Trigonometrical Survey[5].

[1] DDn. 262 (37), 20-7-30; 265 (29), 27-7-30; B Pol C. [2] on ¼-inch and 8-mile scales, 76 (44-50); 78 (33-7); a printed reduction appears in *Bengal & Agra Annual Guide & Gazetteer*, 1842, vol. II, part II (298). [3] CD to B., Pol., 1-2-32 (18). [4] DDn. 267 (176), 12-11-32 cf. 265 (315-6), 17-11-31. [5] DDn. 565 (436), 5-5-58; chart, *IO Cat.* (55-6).

CHAPTER VII

MADRAS SURVEYS

Re-organization, 1815–7 — Military Institution, 1815–6 — Guntūr Circār, 1817–9 — Coorg, 1815–7 — Pondicherry & Madras — Northern Circārs : Masulipatam & Rājamundry, 1815–23 — Vizagapatam & Ganjam, 1824–30.

THE topographical surveys of Madras Presidency ran more efficiently and smoothly than those of Bengal for several reasons [II, 130].

Firstly.—There were no major wars within the Presidency after the fall of Tipu in 1799.

Secondly.—There was an establishment of trained country-born assistants [I, 382–4 ; II, 340–52].

Thirdly.—There was a body of military officers trained in mathematics and survey at the Military Institution [II, 314–21].

Fourthly.—Colin Mackenzie, who had been employed continuously on survey since 1792, and became Surveyor General in 1810, insisted on the organization of surveys on systematic lines. He allotted definite administrative areas to organized parties, each led by an experienced military officer, with several sub-assistants or assistant surveyors and an interpreter [4].

With such an organized party, each survey could carry on continuously till the area was completed even if the officer in charge fell sick or died, whereas in Bengal the sickness or transfer of the surveyor in charge usually meant the abandonment of the survey [4, 18, 49, 140].

Fifthly.—Not only was the country generally suitable for triangulation, but Lambton's survey, which had been extending steadily since 1802, provided accurately fixed points and bases from which the topographical surveys could be started with confidence [II, 233–4 ; III, 225].

During Mackenzie's absence between 1811 and 1815 [II, 299, 302–3], Morison had continued the various surveys much as Mackenzie had left them.

Garling, with Conner and a few sub-assistants, completed the survey of Goa and Sonda ; Dunigan and his sub-assistants completed the Ceded Districts and extended survey into the hill areas of Nellore ; the Military Institution continued the survey of North and South Arcot and south Guntūr, and parties of assistant revenue surveyors continued district surveys for the Collectors or the Department of Tank Repairs. Officers of the Quartermaster General's survey branch were mostly working on the northern frontiers of Hyderābād and Berār.

Shortly after rejoining in April 1815, Mackenzie was appointed Surveyor General of India, his headquarters to be at Calcutta, but he obtained permission to remain at Madras in order to re-organize the department there and, in spite of frequent calls from the Supreme Government, did not reach Calcutta till August 1817.

His first task at Madras was to draw up a statement of all surveys that had ever been made in the Presidency, and to assess their value for mapping[1]. He then worked out the distribution of available surveyors, and obtained approval to four survey units—under Conner for Coorg [97]—under Sim for Masulipatam [100]—under Garling for the Nizām's territories [114–5]—and finally under Ward for Travancore [105]. He retained five sub-assistants for the drawing

[1] Map, scale 48 m. to an inch, with memoir, MRO. map 18 : reports between Dec. 1815 & Oct. 1816 ; MPC. 442 (4517–4600), 11–11–16.

office at Madras, and arranged for the closing of all district surveys except those under the Tank Department [II, 139].

He drew up rules for work and general procedure after discussing the Bengal regulations with Crawford at Calcutta [II, 302].

He was at pains to show that under his new distribution he effected a considerable reduction of expenditure from that of previous years [II, 336–7]. He reduced the number of draughtsmen at headquarters, and set his face against the multiplication of maps. He disclaimed all responsibility for large-scale plans of forts and cities, which were to be the responsibility of the Chief Engineer or the Quartermaster General[1]. By saving expenditure at headquarters he employed more surveyors in the field, and even had their allowances increased; "the speedy employment of the surveyors in the country is the most economical mode of employing an establishment[2]."

He revised the schedule of headings for memoirs on the history and resources of the country, and the manners and customs of the people. In a report of 1820 he compares the good progress of the Madras surveys with the lack of regular system in Bengal, pointing out

> the advantage of a fixed system, and the inconvenience of expending the...talents of our surveyors on labours that, under one general direction, might be so much more extensively applied *in a climate where the constitution is liable to such peculiar interruptions and casualties*[3].

As Surveyor General he was not responsible for the Military Institution, though he advised as to the area for survey and the custody of completed maps; nor was he responsible for the professional work of the observatory or of Lambton's trigonometrical survey; but he was responsible for presenting their accounts, and also for regulating the pay and allowances of the staff. He writes in May 1816;

> Keeping sight of the primary object of reducing the expenditure...without sacrificing what is so far advanced, it has been an object of solicitude with me to restrict...the surveys ...within the present expense, properly under the Surveyor General; which, by the abolition of that office here, will be considerably diminished. ... Within a few years, by the termination of the geographical surveys on the plan proposed, I trust the whole expense may cease excepting such moderate establishment as Government may conceive permanently necessary in aid of the general purposes of this Presidency, and of what the adjustment of...landed property and rights may occasionally require[4].

After the transfer of Lambton's survey the annual expense of all surveys in the presidency fell within 28,000 *pagodas*, or £ 12,000 sterling[5].

MILITARY INSTITUTION, 1815–7

The Military Institution was closed down from 1st June 1816, so that the last class of students which joined in July 1815[6] had a course of twelve months only, doing one field season in Guntūr [II, 319–21].

The fair mapping of the later seasons was entrusted to Mountford[7] who, with Montgomerie, had mapped the earlier surveys [II, 129–30 ; pl. 11]. Besides drawing a reduced map on the one-inch scale Mountford "arranged the triangles" and put all the records in good order for storage in the Surveyor General's office[8]. He had to leave more than half the village names in pencil as they differed materially from the official list of villages, as the officers had not been

> supplied with proper persons by the Collector to point out the villages with their proper names by which they are known in the circar list. The total number of square miles surveyed amounts to 1917, of which about 1450 are comprised within the Guntoor District, leaving an extent of about 1500 square miles on the borders of the district yet unsurveyed[9].

The faulty names were put right during the survey of the remaining part of the Circār.

[1] DDn. 149 (27), to Mountford, 2-1-19. [2] MPC. 10-5-16 (28). [3] BM Addl MS. 14380 (f. 43/18). [4] from SG. 18-4-16, MPC. 10-5-16. [5] DDn. 151 (148), 26-2-18. [6] MMC. 22-12-15 ; MGO. 17-4-16. [7] ib. 15-7-16. [8] DDn. 156 (79), 26-8-16. [9] Report, 2-1-17 ; MMC. 19-6-17.

During its existence from 1805 to 1816 about 140 officers had passed through the Institution, completing a course that was usually two years. As an essential part of their training, these officers had surveyed by planetable about 14,000 square miles of the Carnatic [215, 316], on a scale of four inches to a mile [II, pl. 24 ; III, pls. 11, 24][1].

Reduced to the one-inch and ¼-inch scales, these surveys formed a valuable contribution to the geography of South India, especially as they were properly connected to Lambton's triangulation [II, pl. 16]. Their chief defects were the spelling of names and the omission of administrative boundaries. Mountford explains that boundaries were disregarded because the "object of the surveys" was to accustom the students "to a readiness and facility in expressing the various features of the country at sight, in reference to military rather than revenue purposes".

As might be expected from irresponsible young officers under instruction, the standard of accuracy varied considerably, and the officer in charge of the party which surveyed Nellore District in 1841 points out

> discrepancies...from a personal examination, viz.—the villages not correctly placed or named—the tanks, topes, and hamlets, scarcely one half are introduced—and the interior talook boundaries altogether omitted—in some parts the features of the country appear to be imaginary, and the superficial drawing erroneous[2].

GUNTŪR CIRCĀR, 1817–9

Mountford had been instructor in charge of the Military Institution classes in Guntūr during 1815 and 1816, and just before Mackenzie left in 1817 he was sent up again with a small party[3] to complete the survey. He found that the earlier work had practically to be resurveyed, as boundaries were "more numerous and intricate than was expected", and many villages names had to be verified.

Work was interrupted several times by scares of *pindāri* raids, and by withdrawal of surveyors and their squads to places of safety[4] [100].

Mountford was called down to Madras in September 1818 [318] and Dunigan was left in charge[5]. On the completion of the survey at the end of 1819, the party was transferred to Ellore, north of the Kistna [101]. Mackenzie instructed Mountford that the maps should

> be copied, and even reduced, under your directions. ... The original...might be retained in your office, and the fair copies sent here [Calcutta]. I will send you hints for a memoir of Guntoor as soon as I can. I could wish them to be as ample as you can make it, as it would give me pleasure to transmit it to England as your particular work, at last, after we have been 30 years in possession of it [I, 111]. Be preparing materials meantime quietly. I can furnish its history; the descriptive part you will not find difficult, and even then I can add to your memoir. Perhaps it will be well to send me the rough draft as you go on...and I can make my remarks as I knew much of that country once [I, 112][6].

A huge paste-up on the one-inch scale is still preserved with a beautifully drawn reduction by Ignatio [316] on the ½-inch scale, with fine panoramas of hills and artistic clumps of trees[7].

In 1825 the Collector of Guntūr asked that Palnād should be re-surveyed ; "The map of Guntoor Cirkar only is so very good that really it would be a pity to make up...the country of Palnaud from the materials now available[8]". This *tahsil* had been surveyed by Beatson as long ago as 1788 [I, 110, 193], and only lately incorporated into Guntūr. It was not until 1829 that Morland with two assistants[9] could be spared from Hyderābād, and

[1] MRIO. 134 (19–20), ¼-inch scale ; beautiful specimens of the reduced maps. [2] DDn. 386 (212), 2–1–41 [3] Dunigan, Chamarett, Anderson, and later Terry and Faulkner. [4] from Riddell, 6–3–18 ; MMC. March 1818. [5] MRO. Map 18 A, Terry's map of Nizāmpatam, 1818–9, is a good sample of the work. [6] DDn. 149 (41), 23–2–19. [7] 1-inch, MRIO. 140 (13) ; ½-inch, ib. (16) ; ¼-inch, ib. (14), with complete list of villages. [8] DDn. 184, 31–1–25. [9] Hill and Long.

MADRAS MILITARY INSTITUTION

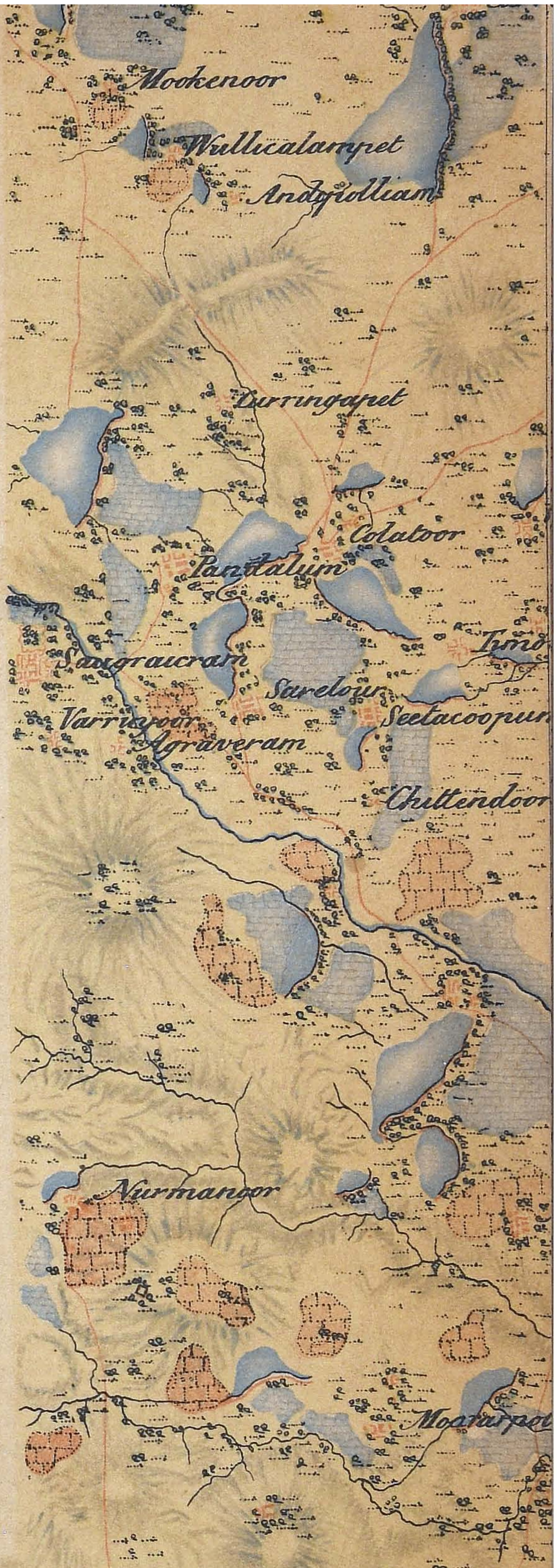
Slightly reduced from one-inch map compiled by Montgomerie from four-inch survey by students of the Institution, which was closed in 1816 [95–6].

Survey was carried out by plane table under the direction of Anthony Troyer in sections $4\frac{1}{2}$ miles north to south by 6 miles east to west, and based on minor triangulation springing from Lambton's main or secondary triangles.

Administrative boundaries were not surveyed. This section falls towards the N.W. borders of South Arcot district.

D. Montgomerie

A. Troyer



Reg. No. 4845 HD'50-800'52.

Printed at the Survey of India Offices (H.L.O.).

the survey...comprehending 1098 square miles, was completed by the middle of May, notwithstanding that both sub-assistants were sick for some time, and that Lieutenant Morland was very little acquainted with duties of surveying. ...

The whole of the records...were safely received yesterday, with the exception of the beautiful map, which has unfortunately sustained some injury from the rain[1].

I cannot but...express my entire approbation with the manner in which the survey of this small district has been completed. ... The features of the country appear to be faithfully and beautifully delineated, and the whole of the documents appear complete. ... The drawing and description of ancient tombs and pillars are valuable and interesting[2].

COORG, 1815–7

On completion of the survey of Sonda early in 1815 [II, 158–9], Garling was appointed to survey the Nizām's territories, whilst Conner was sent to Coorg,

at present a blank upon the map of the peninsula. In a military as well as a geographical point of view, this defect should be remedied as early as possible ; and I would strongly recommend that the Resident in Mysore...procure the permission of the Rajah, ... giving such explanations respecting the utility and object of the survey as may be deemed expedient. The Rajah might be furnished with a plan of the country, ... as proposed...with respect to Tondiman [II, 147][3].

Conner started work with three assistants at the beginning of January 1816, being warned "to be particularly attentive to any instructions...from the Resident at Mysore". He was given copies of earlier surveys of the boundaries—that with Mysore surveyed in 1805 [II, 105–6]—and that with Kanara of 1806 [II, 111]; "the boundary on the south with Wynaad will perhaps be the only portion of the Coorg limits necessary to be surveyed at this time"[4].

He withdrew his party to Mysore for the rains "as the nature of the climate and country elevated on the highest verge of the Western Ghauts is peculiarly uneven and difficult"[5]. Resuming field work in October, he completed the survey in May 1817, withdrawing once more to Mysore and submitting his maps by the end of October[6]. His account of the survey is contained in a most interesting *Memoir of the Codugo Survey*[7], published at Bangalore in 1870. The surveyors were regarded with great suspicion by the Coorg government ;

A spirit of jealousy (not the less violent because unfounded) forms one of the striking features of its policy, and all strangers, particularly Europeans, are viewed with boundless suspicion. ... From the moment of my arrival in the country I was attended by one of the principal officers...and two more of inferior quality ; a shanbogue, or native writer, formed the fourth member of the retinue by which I was invariably encompassed, under the plausible pretext of lending their assistance ; but a short time, however, had elapsed before I learnt the nature of their office, which was literally as a guard, more effectually to prevent any communication with the inhabitants. ...

This restraint, or rather imprisonment, ... in which I was held...was extended even to my servants, and equally strictly observed with regard to the assistant surveyors. ... To such an extreme was this feeling of suspicion carried that I have the best reason for believing that a minutely detailed account of each day's transaction was regularly forwarded. ...

These feelings of distrust operated...only in preventing any intercourse with the people, as a free and ready access was given to all parts of the country, so that the geographical portion of the work suffered no impediment. ... A disinclination to increase the...suspicion...prevented a survey of the Fort (Muddukayray)[8] being taken on a very large scale, and by absolute measurement with the chain ; such a proceeding...would have produced considerable uneasiness.

PONDICHERRY & MADRAS

Pondicherry and Kārikāl had been in British hands since their occupation in 1793, and now that Napoleon's power was broken they were restored to France.

[1] Map, scale 1-inch to m., MRIO. 147 (12–14) ; memoir, M 37. [2] from DSG. DDn. 236 (141, 153), 26/28–10–29. [3] Mackenzie to Govt. ; MPC. 17–3–15. [4] ib. 8–12–15. [5] ib. 28–9–16. [6] Maps, MRIO. 133 (7) ; 146 (8, 9, 10) ; MRO. M 82. [7] MRIO. M 1, 2, 3, 5 ; routes, M 4. [8] Madikeri, "clean town", now Mercara, capital of Coorg, *Imp Gaz.* XVII (292).

The Surveyor General was directed that

the territory formerly belonging to those two settlements, and particularly their boundaries, may be surveyed without loss of time, and...such parts of that territory as are held on jaghir tenure[1] may be distinguished from the rest.

Duncan Sim and James Summers completed this survey by 5th August 1816, with the assistance of the 4-inch survey made by the Military Institution[2], and lists of villages and descriptions of boundaries provided by the Board of Revenue. To provide for the many isolated villages, it was then decided to make an "exchange of villages so as to complete the arondissement" at both places, and Sim was kept on till 1819[3] to assist with "every information for restoring the territories which belonged to the French on 1st January 1792"[4]. He was then employed on similar duty at the Dutch settlement of Pulicat. His maps were duly signed by the French and British commissioners, that for Pondicherry being entitled ;

Map of the districts belonging to the French government dependent on Pondicherry, distinguishing the possessions held in jagheer, with their limits, with the Hon'ble the English East India Company's districts laid down from actual inspection & survey of the villages, and agreable to the official lists and communications in the Revenue Department[5].

This was signed at Pondicherry on 18th March 1818, the French commissioners being le comte Du Puys and Mons. Joseph Dayot, "Administrateur" of the French settlements[6].

In 1819 Mountford prepared a map of Madras and its environs at the request of the Chief Engineer, De Havilland ;

The survey executed in the 1805 and 1806 by the officers of the Military Institution [II, 125] being the most recent, ... the document now forwarded has been copied from...that survey upon the scale of four inches to a mile. In order to insert the limits of jurisdiction of the Supreme Court, I have availed myself of a map of earlier date [I, 94–5]. ...

In consideration of the various alterations and improvements, ... the late Lieutenant Riddell was induced...to suggest...the correction of the...former survey. ... I have...left blank the grounds then under cultivation, the better to admit of these changes being introduced, should it be...expedient to employ an assistant surveyor for...ascertaining them.

The area occupied by the Fort is also a blank, it being presumed that the insertion of those works would be unnecessary. ... Few of the garden houses have their names entered. ... My motives for not entering more arose from...their having been designated...by the then tenants, and not by the original proprietors, after whose names several are best known[7].

Mackenzie had always refused responsibility for large-scale maps of cities and forts [95], and was indignant that his staff should have been employed on such a map ;

How Riddell came to propose this...survey...I cannot conceive. Nothing in my directions ...countenanced it ; on the contrary, ... I wished it to be considered out of the Surveyor General's superintendence, and rather as connected with military defence and fortification, and I am sorry to see that work had been prescribed to the office which I had myself studiously avoided while I was at the Presidency.

A very good map of Madras has been published in England, which would have well answered the purpose, as the Court of Directors...know of it, for without their countenance I scarcely suppose a work of that kind would have been published, being taken aparently from the surveys executed at their expense. ... A copy of it was sent to me by my booksellers from London some time ago ; it has been some time in Lord Hastings' hands, or I would have sent it to you. ...

All this is for your information, and by no means tending to find fault with you[8].

This English map was entitled *The Environs of Madras ;* surveyed in 1814[9] ; published by W. Faden, Charing Cross, 1st December 1816 ; scale about 4 inches to a mile. It shows the names of occupants of houses, e.g.—Colonel Caldwell opposite the site of the present Spencer's Hotel—Colonel Blacker, on the banks of Long Tank, south of St. George's church, where the present cathedral stands.

In 1821, in response to a call for a map for the "Justices in Session" the Chief Engineer regretted

[1] M Rev Bd. 22–1–66 ; *jāgīr*, permanent grant of land to holders and heirs, free of rent [I, 133]. [2] MRIO. Misc. 2–O–07. [3] and Summers relieved by Wm. Bird. [4] DDn. 151 (31), from Riddell, 1817 [5] MRO. Map 291. [6] MRIO. Misc. 3–O–16 ; Map of Karikal, sd. 17–12–18 ; ib. 4–O–16 ; Fdbk. M 50. [7] DDn. 148 (13), 16–1–19. [8] DDn. 149 (41), 23–2–19. [9] Surveyor not known.

that there is no correct plan of the town and suburbs of Madras in the office, and I believe that His Majesty's Justices have a copy of the only one I possess, of which a copy was also lately prepared for the Superintendent of Police[1].

Government accepted Mountford's recommendation "that every useful purpose will be answered by the revision of the map of Madras executed by the officers of the Military Institution", and this was carried out by William Ravenshaw, whose map published by Parbury and Allen is advertised as

A Plan of the Town of Madras and its limits, as surveyed in 1822 for the use of the Justices in sessions; by W. Ravenshaw, Captain, Civil Engineer. Two sheets and a half. Double elephant. Price £ 1-5 s II (438)[2].

A later map was produced by Montgomerie;

Survey of part of the western suburbs of Madras, comprehending the several roads and garden houses in the vicinity of Perambur, Veperi, ... Egmore. ... Executed with the planetable, and the whole finished by the apprentices of the Surveyor General's establishment in the course of their practice in the years 1825 and 26 [32, 377]; scale 200 yards to an inch[3].

NORTHERN CIRCĀRS; MASULIPATAM & RĀJAHMUNDRY, 1815–23

Late in 1815 Mackenzie started the survey of the Northern Circārs by sending out a small party under William Scott, who had for many years been the senior instructor at the observatory surveying school.

These Circārs, which include the present districts of Kistna, Godāvari, Vizagapatam, and Ganjam, stretch from the Kistna River along the east coast to the Chilka Lake. After the district of Chingleput, or the *Jāgīr*, they were the earliest provinces in the Madras Presidency to be ceded to the Company, the *dewāni* having been granted by the Emperor of Delhi in 1765 [I, 91]. No regular survey had been made since the abortive efforts of Pittman and Stevens in 1771 [I, 92–3].

There had been suggestions that Lambton should carry his main triangles up the east coast instead of through the Nizām's dominions, thus connecting with Upper India through Madras territories, but the importance of continuing his grand arc up the central meridian made this impossible [226]. Mackenzie writes to Government in 1816;

The survey of the *Northern Circars*, it is well known, was an early object of survey (next to the Jaghire). ... We have no complete survey of any of the districts; parts of some surveys, and combinations of other materials of various or doubtful merit or authenticity, form the basis of the maps of the Circars now in use[4]. ...

Having for some time looked to the nearest of these districts...as a proper object of commencement, I have given the necessary instructions to Assistant Surveyor Scott...and two apprentices (and two assistants are to follow) to proceed on the survey of the circars of Condapilly[5], Ellore, and Masulipatam, forming the present Collectorate of Masulipatam, lying between the two rivers, Kistna and Godavery. ...

This beginning may be considered as a part of the general design of surveying the whole of the Northern Circars. I would propose that another party be sent into the further parts as soon as the general plan of the department is determined on. ...

The parties once set in action should persevere on one undeviating plan, without interruption by other employment or duty; by such a system alone the design and its expense may be finally terminated within a reasonable time, and the failures in former attempts, and their attendant waste of money and time, be avoided [t-page]. ...

The Circars, by two parties under intelligent officers, might be completed within 3 years. ... The call for reduction of immediate expense induces me to refrain at present from requiring more, tho' I am aware that the frequent casualties of the climate might render them necessary. ... It tends to accelerate the final extinction of all expense by completing the surveys altogether. ...

After the completion of Travancore and Coorg, the surveying parties may be then transferred to the northern surveys at no very distant period, which would hasten the final

[1] DDn. 192 (152), 23-5-21. [2] *As J.* XVIII (145), Aug. 1824. [3] MRIO. 189 (14). [4] ib. 131 (2), rough sketch NW. boundary Ellore; undated; 5 m. = 1½ inches. [5] Kondapalli, 10 m. NW. of Bezwada, 65 D/10.

completion of that interesting object, the geographical and provincial survey of the whole of the Company's possessions under this Presidency.

I have stated it as my opinion, ... from experience and observation...of the native surveying establishment [359], ... that they should be employed as much as possible under the direction of intelligent European surveying officers ; and I consider the survey of the Northern Circars of that consequence to be properly committed to two officers[1].

Scott was sent up to Kondapalli in November 1815 with the two youngest apprentices[2], and was joined two months later by Henry Hamilton and Marcellus Burke. It had been Mackenzie's intention to send Sim with three other assistants to Rājahmundry, and that Sim should absorb Scott's party, and take charge of all survey up to Chicacole[3] [94] ;

The fair season meantime passing, and the late irruption into the vicinity of the Circars having disturbed that country [96], I considered it more beneficial...meantime to employ Lieutenant Sim in verifying and expediting the survey of the Pondicherry lands [98][4].

He explained later that Kondapalli Circār

stretches west of the fortress of that name on the frontier of the Nizam's Dominions north of the Kistna and, altho' a thoroughfare road leads thro' it to Hyderabad, ... the early attempts to survey it had never been compleated. As the survey of its limits will give us at the same time that of the Nizam's frontier on that side, not above 110 miles from that capital, and as this tract has been always much exposed to the depredations of lawless banditti, I was willing by an immediate effort to get clear of it in the first place, as the survey of the low flat country about Masulipatam, which has been frequently traversed by surveyors, can be always more securely completed under protection of our home stations.

The field work was commenced about the middle of February [1816]. ... Operations... have been rapidly carried on until the 11th of March when a temporary interruption was occasioned by a body of Pindaries [82], ... the rumour of which had previously alarmed the inhabitants, and...disturbed the party when the banditti crossed the Kistna thro' the tract under survey. The only accident, however, ... consisted in the loss of the little baggage of Assistant Surveyor Hamilton. ...

The duty was resumed as soon as the alarm ceased, and Assistant Surveyor Scott, who was employed on the furthest part of the survey, states that "the progress then had not been so rapid until the alarm subsided". On the 8th June it was also somewhat interrupted by the land winds which are usually there severe, and some sickness had prevailed.

He asked for re-imbursement for the loss of Hamilton's baggage,

pags. 48–0–10, which being a moderate amount of necessaries barely belonging to his station, ... in consideration of his good conduct...in exercise of his duty and of his having saved the public instruments[5].

This may have been the gang described by Lord Moira ;

A village was surrounded by the Pindarries. The horrors perpetrated by these demons at other places made the poor villagers...fly to the desperate resolution of burning themselves with their wives and children. ... I am strictly forbidden by the Court of Directors to undertake the suppression of the fiends who occasioned this heart-rending scene, lest I should provoke a war with the Mahrattas. ... All the young girls are carried off by the Pindarries, tied three or four like calves on a horse, to be sold. ... The different columns which penetrated the Nizam's territories and ours in this last irruption...could not amount to less than 23,000 horse[6].

Mackenzie reported in November that,

on the whole the progress...is satisfactory : and I am the more anxious for its completion as it embraces, besides the extensive boundary, a survey of several small districts of the Nizam's, ... including the diamond mines of Purtyall[7] [II, 405], which are isolated within our territory, while we possess two small districts detached within the Nizam's. ...

I feel considerable anxiety, ... the exposed situation of two parties of surveyors, protected only by...five sepoys ; and from my own knowledge of the country...I request...sufficient protection of guards to each of the parties...on the frontier[8].

Again, in July 1817 ;

Tho' the irruptions of the Pindarries had occasioned some uneasiness so late as June, the assistants afterwards appear to have gone on with spirit, and no further application for guards became necessary, the presence of a detachment at Condapilly having relieved their anxiety.

[1] SG.'s letter, 14–12–15, MPC. 12–1–16. [2] Anderson & Barnett. [3] On the border between Vizagapatam & Ganjam, 65 N/15. [4] from SG. 18–4–16, MPC. 10–5–16. [5] from SG. 1–8–16, ib. 28–9–18. [6] Hastings' *Journal* (248–9), 15–4–16. [7] Map shewing mines, 1816 ; 2 inches to mile, MRIO. 67 (5, 6); Purtiala, at junction of Muneru R. with Kistna 65 D/6. [8] MPC. 11–11–16.

I regret, however, to report that from another quarter the survey lost some of its instruments when there was less danger expected. Immediately on the arrival of an assistant at Mungulgeery on the Kistna, in October 1816, before a guard could be supplied, ... he was robbed of one of the most valuable of his instruments, along with some property of his own, from a public choultry, and notwithstanding every investigation the instrument was not recovered[1].

The Kondapalli survey was completed in August 1817[2], and the party moved to Masulipatam, where Summers had started survey in 1816. Hamilton and Burke were now transferred to Bengal, marching up the coast, whilst Scott followed by sea in March [360, 374], leaving Summers in charge ;

Considerable progress has been made in the details of the Masulipatam survey, and...he has every hope of this part of the work being shortly concluded, with the exception of the town and environs of Masulipatam which, being a very curious and extensive place, ... will be...carefully surveyed...on a large scale (viz., 4 inches to a mile)[3]. ... Respecting the trigonometrical operations, he cannot report so favorably, as there is much to be done yet...to form a connection...with the former stations.

Though the survey was started from sides of Lambton's triangles, only one station fell inside the district, and a base-line had to be measured near Ellore. Mackenzie wanted a good man for the job ;

I wished to have a good chain sent to measure a base in the...Ellore or Rajamundy Circars, ... but under the direction of an officer, as I cannot think of committing such a duty to Mr. Dunigan again without some control. Pray write me how he satisfied you while under inspection. He was once capable enough, but failed so much in the latter part of his Ceded District work, that I am afraid to entrust him. It is a pity he is the senior there, the best way will be to send an officer[4] [339–41].

Officers were, however, not so easy to get ; Sim could not be spared from Pondicherry [98], and most of the surveyors were away in countries newly won from the Marāthas ; some had taken leave to England after the war.

An officer should be selected for...charge of the party...now in Guntoor and Ellore. I have been waiting for the conclusion [of the Guntur survey] by Dunigan etc., and to enable you to complete the whole memoir, map, etc., in your own name [96], and then to transfer the whole at once under one officer to survey Ellore (the rest of it) and Rajamundri. If Sim is sent, it is well, but he wrote me some time ago that his health was indifferent[5].

No officer being forthcoming, Dunigan was given charge at Ellore[6], with instructions to "select a convenient situation for measuring a base...near the south bank of the Godavery"[7]. He did not clean up the Guntūr survey until December 1819, but sent up Anderson and Barnett in advance.

Early in 1820 Mackenzie secured the services of Richard Hodges who had been at the Military Institution during 1813–4. He met Dunigan at Ellore, and in May 1820 measured a base-line on the borders of the Colair Lake[8]. The ground was carefully levelled, and the measurement repeated four times. It cannot, however, have been of a high order of accuracy, as the links and rings of the chain opened out and broke repeatedly. Hodges died in July 1820, and Charles Snell, who had been at the Military Institution from 1814 to 1816, took over charge in November. Two months later, after connecting the base-line to Lambton's work on the Kistna, Snell started his own triangulation northward.

The party was now designated the Rājamundry Survey, and comprised Snell, Dunigan, Bird, Faulkner, Anderson, and Barnett. Snell carried on the main triangulation himself whilst Dunigan did minor triangulation and survey of important boundaries. A Madrasi interpreter, or *goomastah*, collected statistics, village names, and historical records. Bird and Faulkner died during 1821.

The north or hilly area of the district is covered with jungle, and has a climate considered highly obnoxious and unhealthy, especially during the rainy season. The plains area was studded with lofty trees of different descriptions, and rendered...the survey extremely tedious, and entirely interrupted the trigonometrical operations[9].

[1] MRIO. M 561 (243) (e), 31–7–17. [2] Fdbks. MRIO. M 50, 36, 87 ; M 15 ; Maps, ib. 134 (7) 138 (44–6, 51-2) 139 (15–7), 189 (12). [3] from Riddell, 6–3–18 ; MMC. 655/1818. [4] to Mountford ; DDn. 149 (46), 24–2–19. [5] ib. (65), 22–4–19. [6] 65 H/2. [7] DDn. 148 (200), 26–10–19. [8] Memoir, MRIO. M 89. [9] ib., Report.

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Owing to the lateness of the regular north-east monsoon the party took the field in January, and worked on till the end of June. In 1822 another base was measured, and "coincided with great exactness with the trigonometrical operations". Again the chain was of very poor make, the links opening and breaking almost every 100 yards. Mountford reported in August that the surveyors

have been driven from the field by the heavy rains, and have taken up their residence at Nellapilly. ... The unfavourable nature of the country, on account of an excess of wood and water, does not admit of so rapid a progress as is made in other quarters[1].

Again in November 1823,

The country near the sea, being much intersected by water and covered with extensive plantations of palm trees, has rendered this a tedious and prolonged survey; however I trust it, and a portion of the Chicacole District, will be completed during the ensuing season. The party is at present assembled at Ingeram for the purpose of protracting and copying their work, but they will resume their field labours so soon as the state of the weather and country will admit[2].

Snell reports that

the tract of country among the hills...constituting a part of the northern boundary, is wild and uncultivated, with here and there a few huts huddled together, not deserving the name of villages, and thinly inhabited by a race of people as wild as the country. ... The difficulty of procuring supplies, the wild and inaccessible nature of the country, with the want of roads and its...noxious climate, have rendered the survey hazardous and laborious.

There does not at present remain any very considerable portion of the district to be surveyed. The extent of that among the hills, being a jaghire...belonging to the Rumpah Zamindar, is difficult to ascertain, but the unhealthy climate is but too fatally known to all its neighbours, who dare not approach its borders except at particular periods, and not then without considerable risk and danger[3].

At the close of the Rājamundry survey in 1824, Montgomerie wrote that

the features of the country are very minutely and well delineated. ... It is to be regretted there is a blank space in the map which should have been occupied by the Rumpah Jagire, but the tract being considered very unhealthy, the survey of it was never undertaken.

Having discovered many errors in the original register of triangles[4], ... the whole series from Colonel Lambton's distance Condapilly to Munglegherry was recomputed...in this office, by which the errors between the bases of verification were more equally divided[5]. The survey rests on a triangulation extended by Captain Snell from the nearest of Colonel Lambton's triangles in the Masulipatam collectorate, and verified by bases of verification.

The detail was taken up by the plain table, angular instruments, & field books. No useful detail has been omitted, and boundaries of every description have been inserted with the greatest care, and although the hills are not so well expressed as could be wished the survey is one of great value[6].

VIZAGAPATAM & GANJAM, 1824–30

From 1824 Snell and three assistants worked northwards through Vizagapatam Circār, and during the rains of 1825 measured a base-line in the neighbourhood of Vizagapatam, on "a narrow and confined spot of swampy ground"[7].

In December 1825 he took leave to the Cape on medical certificate, and before starting brought the whole establishment to Madras [376]. The survey was closed down during his absence, as Dunigan's health was not good, and Montgomerie had "not sufficient confidence in the zeal or energy of Assistant Surveyor Anderson to recommend the party being sent under his charge"[8].

Snell rejoined at Vizagapatam on 5th January 1827, and his assistants shortly after. In October he was joined by Richard Otter, who proved of no use and resigned two years later. The hilly area of Vizagapatam is densely wooded and most unhealthy, and progress during the next two seasons was disappointing, being confined mostly to the more open coastal strip[9]. Montgomerie wrote to the Surveyor General in disgust;

[1] DDn. 194 (134), 28–8–22. [2] ib. 209 (272), 27–11–23. [3] ib. 200 (178), 1–9–23. [4] ib. 181, M 91. [5] ib. 237 (161), 6–7–29. [6] ib. 246 (120). [7] DDn. 202 (133), 1–6–25. [8] DDn. 218 (241), 15–9–26. [9] Maps, MRIO. 134 (14).

The progress that Captain Snell has made in surveying the Northern Circars since he has been in charge...is, in my opinion, quite contemptible, and for the sake of the service I do hope you will address me officially on the subject[1].

Work was pushed northwards along the coast during the next season, and the rains of 1829 spent at Berhampur in Ganjam[2], but the season's output brought another indignant letter from Montgomerie ;

The...country surveyed, ... 992 square miles only, might...have been accomplished by one active surveyor instead of the whole party. ... A wrong system must have been pursued, or... there must have been a want of zeal on the part of the several individuals. ...

The area surveyed...during the last two years...amounts to 1778 square miles ; ... the expense...will not be much under 29,000 rupees. The party in Malabar, which is the same strength as yours, and where the country is exceedingly difficult, accomplished...1800 square miles last season. ... In Malabar the surveyors have not confined their operations to the cultivated and inhabited tracts only, but have successfully surveyed the wildest parts of that woody and mountainous country.

Whilst the survey under your charge has been at the rate of 16⅓rd rupees the square mile for the last two years, which is an expense far greater than was ever incurred for any other survey, ... the expenses...in Malabar for last season where every difficulty was overcome, and where the officer in charge is granted a higher salary on account of zealous length of service [350], amounts to 9⅓rd rupees the square mile.

The narrow tract between the hilly country and the coast, to which you have hitherto confined your operations, ... appears most favourable for the rapid progress of the surveyor, and Lieutenant Otter's total neglect of duty during the past season cannot be considered a sufficient reason for so little having been done. ...

The accompanying sketch exhibits the limits to which your present survey has hitherto been confined. The boundary between our territories and those of the Nizam and Nagpoor Raja has been inserted chiefly from a map lately published by Cary [289] ; it cannot of course be much depended upon, but there must be a very considerable extent of country between that boundary and the eastern crest of the hilly range to which your survey has in some places reached, but within which I am not aware that a single new point has been determined, or that any attempt has been made to do so, further than by enquiries as to the climate, which you have heard is considered unhealthy. But, as the tract...appears from printed maps and routes in my office to have been traversed in several directions, it may excite surprise should no geographical information whatever be gained by surveyors expressly appointed[3].

In spite of Montgomerie's strictures, he accepted the Collector's advice that a full survey of the notorious Jeypore district should not be attempted [82] ;

I am not aware of any serious impediment to the survey of the Jeypoor zemindary, except the unhealthiness of the climate. Admitting the reports...regarding the badness of the road leading over hills and through dense masses of forest and jungle, and requiring at least five days to accomplish the journey, ... none of these difficulties are insurmountable. ...

The only real objection to the extension of the survey to Jeypoor is the risk to which the lives of all employed would be exposed from the insalubrity of the air, which is well known to be generally fatal to the inhabitants of the open country.

I am not prepared to say whether the air may be more or less pestilential at one season of the year than another ; your own experience...probably enables you to judge...the time of the year most favourable to the human constitution in the hills. ... The natives of other parts of the country have a great horror of visiting Jeypoor, and...many instances have come within my own knowledge of the extraordinary fatality of the air. ... The survey of Jeypoor would be attended with imminent danger to the lives of all those personally engaged[4].

Though he agreed that Jeypore should be omitted, Montgomerie suggested that much valuable information might be gained...by rapid...perambulator measurements of some of the principal paths which traverse it. That this at least could be effected I think is certain from our already possessing some measured routes through that zemindary. But, as those routes are unconnected with any regular survey, they do not possess that value which would be the case with routes taken from well established points in your survey[5].

Snell managed to survey a route fourteen miles into Jeypore ;

The servants and followers refusing to proceed further into the hills compelled me to return. This circumstance, and the want of supplies, are the only impediments...to effect a *perambulator*

[1] DDn. 231 (210), 13–11–28. [2] 74 A/15. [3] DDn. 236 (141), 26–10–29. from Collector, 27–12–28 ; DDn. 237 (27). [5] DDn. 236 (141), 26–10–29.

measurement into Jeypore (the capital...). The wild and hilly nature of the country would not admit of any extended topographical operations. The country to Baudagaum is very wild, consisting of hills and bamboo jungles, the path narrow and passing over several streams; the villages small, ... and no supplies procurable; it required 6 hours to conduct the perambulator...to Baudagaum. Jeypoor was reported to be seventy or eighty miles distant. ... I am still of opinion of the impractibility of carrying the survey into this country[1].

On this Montgomerie commented that

Captain Snell appears to have made a feeble attempt to survey the road leading to the capital of Jeypoor zemindary, and I fear that our information in that quarter is not likely to be extended[2].

There were other obstacles;

The Kimmedy country[3] is entirely up in arms, and the inhabitants in a state of hostility among themselves, so that its survey at present could not be attempted; even at any time it will be attended with much personal risk and danger to the party employed, this zemindary being composed chiefly of hilly country, with large tracts of jungle and uncultivated lands, and inhabited by a fierce and uncivilized race of people.

The disturbances extend to within 6 or 8 miles of Berhampore westward, but as the most advanced of the surveying party will now be employed near, and to the north of, Poondy, I trust that by confining the operations at present to the plains and cultivated country...there will be no interruption encountered, and when peace and tranquility be restored the survey can be conducted to its farthest limits inland[4].

Survey had now entered Ganjam District[5]. Otter had been replaced by Charles Hill who was to prove a very useful surveyor; the only sub-assistants left were Anderson and Barnett. In October 1830 Montgomerie reported that the area

surveyed in the Northern Circars last season amounts to...a much larger quantity than...in former seasons, notwithstanding that the senior sub-assistant [Anderson] was sick in quarters the greatest portion of the time. ... The assistant officer, Lieut. Hill, contributed considerably to this result, although it is the first time...he has been regularly engaged in surveying.

The officer in charge...appears...still to confine his operations entirely to the low country, none of the hilly part of the Chicacole Circar having been surveyed last season, altho' immediately in the vicinity of operations. This may possibly have arisen, however, from the inhabitants...having largely been in a turbulent state[6] [5].

Snell's lack of enterprise was probably well justified, for his party was never more than four or five strong, and the loss of one or two surveyors for several months through ill-health would have crippled it seriously; on the other hand if all surveyors had been so very cautious about their health, there would now be little known of the geography of India. The following extract from a report on the hill country west of the Northern Circārs shows its early reputation, that largely persists to modern times;

Ganjam, Vizagapatam, and Rajahmundry, are countries...different from all the other territories dependent on Fort St. George, chiefly because, bounded to the westward by a wide tract of hill and jungle, inhabited by uncivilized, and indeed unconquered, barbarians, many of them not even nominally dependent on any government; their climate and their poverty have secured them from conquest. No great native government ever seems to have thought this tract worth conquering. It had been left as a waste corner of the earth to wild beasts and Gonds [I, 60–1, 299]; nobody seems even to know the boundary. This tract has never been even explored; there is a blank here left in the maps.

The country at the foot of this range of hills and the vallies which run up between them are fertile, but for the greater part of the year the climate is deadly to strangers, and at all seasons very unhealthy[7].

Snell's survey did practically nothing to fill this particular blank.

[1] DDn. 236 (216), 1-3-30. [2] ib. (218), March 1830. [3] Parlakimidi, 74 B/1. [4] from Snell, Gopalpur, 1-5-30, DDn. 237 (226). [5] Maps, MRIO. 133 (36-8); 140 (12). [6] DDn. 237 (245), 27-10-30. [7] Report by Wm. Thackeray 15-2-19; *EIH Sel.* 1 (980); MRIO. 30-3-19.

CHAPTER VIII

SOUTH PENINSULA & NIZĀM'S DOMINIONS

Travancore & Cochin, 1816–21 — Dindigul, 1821 — Nīlgiri Hills, 1821–3 — Malabar, 1823–30 — Nizām's Dominions ; Garling, 1816–20 — Hyderābād Survey ; 1820–3 — Crisp, 1823–7 — Webb & Morland, 1827–30 — Professional Reviews 1824–30.

WE now come to the surveys of two of the most competent of these Madras surveyors, James Garling and Benjamin Ward. Troyer had selected Garling from the first class of the Military Institution to be his assistant instructor, and at the end of 1810 sent him in charge of a party of officers to survey Goa [II, 127]. When the survey passed to the control of the Surveyor General, the young officers were replaced by sub-assistants [II, 156], and on its close Garling was selected for the Nizām's dominions.

Ward was of British stock and the most successful of the country-born pupils of the observatory surveying school. He came under Mackenzie's personal care and training on the Mysore survey, and then spent more than a year in the Ceded Districts [II, 153–4]. After getting a commission and doing a few months military duty, he held charge of the drawing office at Madras during Mackenzie's absence in Java, and after his return was selected for the survey of Travancore. Arthur's survey which had carried on intermittently between 1807 and 1811 [II, 130–2] had been deliberate, but patchy and incomplete, and the Resident had for some time pressed for its completion, which Mackenzie now provided for ;

As the survey of Travancore has been long in contemplation, this measure is more than necessary now ; it was...suspended in 1810...with a view of resuming it at a favourable period. At present I conceive every motive of utility and economy favours the resumption. To avoid the former errors or avert interruption from climate or casualties, I would recommend that this party be made up to six assistants, which can be well spared from Dindigul[1] [4].

As the survey of Dindigul had not been prospering, it was broken off in 1816, and the surveyors joined Ward for work in Travancore [110], Mackenzie reporting the arrival of Lieutenant Ward at Dindigul on 14th July. After making the necessary arrangements...there, he arrived on the 16th August with three assistant surveyors in the territory of Travancore.

Mr. Ward had a personal communication with the Resident of Travancore in his way thro' Tinnevelly, and was enabled to commence his operations on the 20th of that month, and by his last report of the 1st instant [September], was employed on the detailed survey...in the neighbourhood of Cape Comorin. One of the assistants was disabled from duty by a return of fever which, with the high westerly winds usually prevailing at that season, will retard the operations till the fair season commences.

The following are extracts from Mackenzie's instructions[2] ;

As no information exists in this office of the internal divisions of the Travancore territory, altho' I presume it is subdivided in a similar manner to other countries under a Hindoo administration, and as the nature of the country and of its climate...bear a considerable resemblance to that of Malabar and Canara, ... apply early to the Resident for an authentic list of the provincial divisions of the country, and for orders to the provincial officers to supply you with lists of the villages, etc., in like manner as was furnished in Mysore and in the Ceded Districts. You should also consult the Resident as to the most expedient to be first taken up...of the Divisions. ...

[1] from SG., 14–12–15 ; MPC. 12–1–16. [2] from SG., 18–4–16 ; ib. 10–5–16.

After obtaining every necessary local information, commence your operations, and distribute the parties of surveyors in such manner as...promise to be most advantageous. ... I...recommend you to have the exterior boundary...with the Company's territories well surveyed. ... I understand there are tracts there isolated...which will require particular attention. ...

The roads will, as usual, be a special object of attention. ... The great road from the entry of the southern barrier wall of Travancore, till it reaches Cochin, should be completed in a series of road sheets in the usual form ; the other roads may be added in like manner.

The back-waters, as they are called in Travancore (the inland navigation), form a peculiar feature. ... Ascertain their communications throughout...and the depth of the water by sounding at different times of the year, when the waters are high and low, as surveys of waters cannot be of much use without a knowledge of the soundings and depths.

The maps of districts are to be laid down on the scale already adopted for the other surveys, of one mile to an inch. ...

I enclose a list of stationery and instruments now made up for completing the equipment for your party. ... As the instruments are not always procurable here, and are at all times attended with a considerable expense to Government, ... warn the assistant surveyors to be attentive to their preservation.

Having every confidence in your zeal and knowledge, ... already evinced in those works you have so satisfactorily conducted, any further explanations of the general plan of this work are scarcely necessary[1].

The six assistants—Turnbull, Pereira, Keyes, MacMahon, Aikin, and Bird—had from 5 to 18 years experience on district surveys. Ward based his triangulation on Lambton's triangles, writing from Anjengo on 1st April 1817 ;

I have during the past month extended a series of triangles from Trivandrum[2] to this place and in the interior, taking up the points originally fixed by Lieutenant Stewart [II, 132, 443]. It is my intention during the present month to extend a series over the tract of the northern part of this district, and of that of Kolarcurray, to the great range of mountains, to enable the surveyors...to lay in the features of the country[3].

The following extracts from his journal[4] give a picture of his daily work ;

Thursday, 13th June 1816. Left Madras at 11 p.m., and proceeded by Tripoloor[5] to Manvillypoor ; ... arrived...at 8 p.m. and proceeded to Colonel Mackenzie's tents, pitched on the beach near an ancient pagoda. ...

Arrived at Pondicherry at 10 a.m. on the 15th inst. ... Left Pondicherry 28th. ...

July 3rd. to 9th. Trichinopoly. ... 11th to 17th, Dindigul. ... 18th to 26th, Madura. ...

31st. Courtallum[6]. Reported my arrival to Colonel Munro [II, 196 n.4 ; III, 111 n.4], the Resident in Travancore. ...

August 5th to 14th. Palamcotta[7]. ...

18th. Prepared the instruments for service ; directed Bird and MacMahon to make survey of the country east and south of the line. ... 23rd. Directed Bird and MacMahon to survey the roads from Poonagoody and Comorin to Nagacoil[8]. ...

28th. Ascended and took a station on Murtawa hill. ...

31st. Took a station on Myladdy hill. ...

September 15th. Made a circuit on the eastern limit common to Ternevelly [Tinnevelly District], and proceeded to Arumbullay [II, 242–3]. ...

Oct. 3rd. Oodagerry. Reported my arrival to the Officer Commanding and moved to the neighbourhood of Paupanaveram, to avail myself of the convenience of a bungalow to bring up all arrears of the survey ; the assistants, Aiken, Bird, and MacMahon, having arrived at this station some days previous. ...

From the 5th to 22nd of October, employed within doors with the assistants, protracting the field work and drawing ; procuring registers of villages, and entering the situations of such as have already been ascertained.

The assistants Aiken and MacMahon employed in making a minute survey of the forts and environs, the latter generally employed on this duty, the former on the survey of the roads from this place to Trivataur. ... Bird inserting the situation of villages in the registers, and protracting and colouring the routes surveyed to this place.

On the 7th inst. took a station at the flagstaff on Oodagerry Hill ; on the 10th on the redoubts to the north of Paupanaveram, to fix them as stations for the bases of the survey of the environs.

[1] from SG., 18-4-16 ; MPC. 10-5-16. [2] Capital of Travancore, 58 D/15. [3] M Rev Bd., 26-6-17. [4] *Memoir of the Survey of Travancore and Cochin.* Madras Govt. Press, 1891. [5] Tirupporur, 66 D/2. [6] Kuttalam, famous waterfall [II, 144] ; 58 H/5. [7] Pālamcottah, 3 m. E. of Tinnevelly. [8] Nagercoil, in Travancore, 58 H/8.

25th Oct. Having directed the three assistants to survey what remained of the southern district of Cocolum[1], proceeded...to commence a series of triangles for the surveys of the Coolatoray and Neattengerry[2] districts. ...

3rd November. ... Assistants Turnbull and Perara reported their arrival from Dindigul.

4th. Commenced the calculation of the triangles to the westward, and drew up letters and reports for transmission to the Surveyor General's office. ... 5th. Continued the calculation of the triangles. Assistant Keyes reported his arrival this day. ... 11th. Despatched the three assistants just arrived to survey the districts...to the westward. ...

Dec. 1st. The assistants Aiken and MacMahon returned from survey ; the former and William Bird being indisposed with a fever were directed to proceed and place themselves under the...surgeon at Trivandrum. ...

5th. Proceeded to Tambercolum to execute an agricultural survey of its lands, being in conformity to instructions received from the Surveyor General. ...

6th, 7th, 8th. Investigating into the nature of the tenures and statistical accounts connected with the village and its lands. MacMahon employed on the survey since the 4th inst[3].

Survey was by no means straightforward or easy;

I have now seen a specimen of the Travancore country, and do assure you, My Good Sir, the difficulties we will have to encounter will be much greater than anything experienced in Canara, in consequence of the woody and mountainous tracts, which extend for many hundred square miles, and without a single habitation save those of a few hill people. ...

Plains in this country are only the bottom of deep ravines, which are cultivated and shut in with immense woods & hills. To see even a village or field it is necessary to be on the spot, & tho' the mountains are lofty & at hand, the greatest difficulty must be gone over before [one] can get a sight of the stations. The only method...is to survey from village to village with the wheel & compass, & the tract laid down in this manner will in some respects be erroneous, which...may be corrected when an observation can be obtained. ...

It is my intention in a few days to run over the country between this place, Trivandrum, and the sea, to settle as many secondary stations as may be possible, on which tract, when Turnbull joins, I propose dividing the young men...to allot each a separate district, & when they are employed will at my leisure take an active part towards the mountains. ...

Bird & MacMahon are now well acquainted with the manner of keeping the field book, & they will be able to show the others how it is to be done. ...

We have gone over the whole tract...surveyed by Captn. Blair [II, 131, 382]. ... It seems in every respect to be a very accurate production ; the situations of the villages are laid down minutely, tho' their names I found much corrupted, & I do suppose that the whole has been laid down from trigonometrical observations, or otherwise error would appear in some parts. Attention has not been paid in laying down the extent of the hills to their base, which is the only difference I have observed.

Again, on 4th November ;

Constant heavy rains...with short interval of fair weather. ... I have carried on...triangles as well as the uneven & wooded nature of the country would admit, which will be of great assistance to the young men, but...a great part can only be surveyed with the wheel & compass. Another obstacle to the westward is the immense cocoanut topes, which keep rising from the bottom of glens almost to the summit of the heights, the tops of which are again crowned with lofty wood. ...

I also met with two Tesildars, who are of the Nair caste, & very civil & polite. They have, they said, in consequence of instructions sent to them beforehand, prepared registers of villages. ... Some villages have one name in the circar list, [and] are called by another by the natives, which often occasions great confusion[4].

In May 1817 Ward was deputed to survey the boundaries of Travancore with Tinnevelly and Dindigul under the direction of commissioners who had been appointed to settle them[5]. This was the sort of interruption to the steady progress of survey that made Mackenzie so angry, but against which he could make no official protest. " This survey of the limits of Travancore is a subject that I had no notice of & I know not who the commissioners are at this moment [6]".

Ward suffered the trials common to all boundary commissions ;

May 23rd. Received a letter by post this morning from the Surveyor General, directing me

[1] Kalculum, 58 H/7. [2] Nayyattinkara, 58 H/3. [3] MRIO. M. 106 ; 137 (7) ; scale 4 inches to a mile. [4] to SG., DDn. 156 (176, 181–3). [5] The Cochin-Malabar boundary had been surveyed by Arthur 1815–6. MRIO. M. 107. [6] DDn. 156 (125), 27–5–17.

to proceed and comply with the requisitions of the Commissioners about to be appointed for the purpose of deciding the disputed lands between Travancore, Dindigul, and Tennevelly. ...

The commissioners are Captain Blacker for Travancore & a Mr. Drury, assistant to Mr. Petrie, [I, 175 n.5 II, 265], on the part of Government.

Coortallum, 18th June. I arrived at this place on the 13th instant, having left Quilon on the 10th ; five days have now elapsed & no commissioner has appeared. ... Mr. D. has arrived at Dindigul. ... Capt. Blacker is posting, and will be here in a day or two. ... We then proceed to Cummum in the Dindigul valley to decide the disputes in the Cardamum[1] Mountains &...return to Shencota in this neighourhood. ... I have several documents...connected with the disputes. How this point will ultimately be decided I do not know, but the fatigue & labor attending it will be very great[2].

June 30th. Being given to understand by the Resident that the Commissioners will meet at Cumbum[3] in the Dindigul valley, ... began to make preparations for proceeding.

July 5th. Induced to halt for a supply of cash from Palamcottah ; the exchange of the Travancore fanams[4] at 20% discount was a serious loss to the party. ...

12th. This morning the Commissioners arrived, accompanied by the Collector of Madura. ...

He writes to Mackenzie, 12th July ;

I am impatient, and very anxious to commence on this duty. ... The weather is just now cool and pleasant, with rain at intervals, notwithstanding we have a few sick already.

The whole of the tract in dispute, which lies between the hills & the Perryaur river, ... is extremely wild and very intricate, and much infested by tygers & elephants, and...at times the whole day the fogs are so thick that they [the men] are obliged to grope their way thro' it at the hazard of their lives, & the rain continually pouring down in torrents will, I fear, impede our progress considerably[5].

13th to 17th. The Commissioners, after some days discussions, came to a resolution to forward all the documents produced by both parties to Government for their decision, and ...expressed their wish to me that the tract in dispute...to be surveyed ; I therefore held myself in readiness to execute this duty[6].

He commenced survey of the disputed cardamom lands about 26th July,

and have been labouring ever since, making every exertion to get over it, but to little effect, having to contend with not only the difficult nature of the country which is a composition of hills and narrow vallies & almost uninhabited, but the weather mostly [has] been a barrier to my proceedings.

It continually rains & causes such a damp in everything, that tho' it would be a satisfaction ...to enter upon the protraction of the work, yet...it is impossible. I then take up a book, lie in bed to pass the time. That too I find uncomfortable. We have fires made, and so long as they last it is all well, but when they go out we feel worse than ever.

I went up to one of the highest hills looking towards Dindigul valley one fine day, to take a station, & as soon as I reached the summit such a fog with rain commenced, the like I never witnessed before. On this lofty eminence did we remain for six long days & nights in a small hut made of leaves, in hopes of a fair day. ...

I am just now almost in the same predicament, tho' in more comfortable quarters, sheltered in a deep hollow where the wind is not so piercing, waiting for the fog to disperse. ... These continual disappointments, My Dear Sir, is very vexing, ... separated from my baggage &c., and obliged to go over every inch of ground on foot and, to crown the whole, ... I sent away about a month ago...articles of some value, my best clothes, &c. The party was attacked by a male elephant who spared nothing, destroying the whole, amounting to a considerable sum. How am I to be indemnified ? ...

I have hopes by the end of November to bring it to a final close, when I proceed to Quilon[7].

He had more trouble from elephants ;

Aug. 16th. This evening as a party of coolies about 50 in number were coming up from Cumbum...they were attacked about a mile from this by a male elephant, which rushed upon them and struck a lad of about 18 with his proboscis, and instantly killed him on the spot ; the remaining party endeavouring to get away, some fell and bruised themselves very much.

He escaped from the boundary survey in December ; " I was enabled to quit that vile tract...about the 5th instant, notwithstanding the weather, which became favourable only late in November, ... I arrived here on the 16th instant ". He was glad to get back to his surveyors, about whom he had been anxious ;

[1] *Elettaria Cardamomum*, requires dense shade, plenty of water, and rich soil. [2] to SG., DDn. 156 (214). [3] Kambam, 58 G/6. [4] 42 *fanam* = 1 *pagoda* [I, 278 n.7]. [5] to SG. ; DDn. 156 (216). [6] Ward's Memoir. [7] to SG., 28-10-17 ; DDn. 156 (218) ; boundary survey, MRIO. Misc. 9-O-13.

12th July. Keys is again indisposed, and it is not unlikely he will keep away from the survey till I return. There are now two assistants on duty with Turnbull, & they...do little, on the plea that it continually rains. ...

28th October. I am concerned...that Turnbull & the other assistants do not at all give satisfaction. They have ever since the month of May been on the survey of the Kotarkerry district, and which is...still unfinished...from a want of zeal on their part. Was I on the spot, I am confident that survey would have terminated...early in August[1].

He now inspected their work "which, tho' it embraced but a small portion of country, appeared to be well executed". At Quilon he was glad to welcome Conner, who had brought his small party[2] down from Coorg to assist [97].

Mr. Conner arrived here a few days after me, having left Mysore a month ago. I was surprized to see him here so soon. ... We have...arranged it, previous to commencing survey again, to see the Resident. ... He is now on his tour in Cochin, & is expected to be back soon[3].

Jan. 5th 1818. Left Quilon at 4 p.m.; proceeded in company with Lieut. Conner, and arrived at Aleppy at 9 a.m. on the 6th inst. ... Waited on Colonel Munro[4] and, after a conference, returned to Cochin. ... 8th. This morning again waited on the Resident, and after a long conference, principally on subjects connected with the survey and assistance required [408], we took our leave and returned to Cochin.

Riddell reports that after seeing the Resident Ward seemed sanguine as to expectations of future assistance. One advantage has, he says, already arisen from the interview "in having an additional number of peons alloted to them, whose services will be essentially necessary in procuring aid to the assistants".

Lieutenant Ward has, during this quarter, completed the survey of the disputed tract between Travancore and Dindigull; and the assistants, having finished the Quilon District, have resumed the examination of the woody tracts of Kotarkerry District, discontinued from the difficulty of procuring assistance, and are making considerable progress in the districts of Hunaboor and Umbalapilly[5].

In short, ... the progress of the Travancore survey is as rapid as can be expected. All the country south of a line drawn east and west 12 miles north of Quilon has been finished. This comprises about a fourth of the kingdom, and, calculating on the progressive acceleration that will arise from the increased number of surveyors, we may look forward at no very remote period to the completion of that distant and unhealthy region[6].

In addition to the straightforward one-inch survey of the country, large scale surveys were made of the town and environs of Quilon[7], and of various cardamom gardens. Field work was closed for the monsoon, and resumed on 1st September;

June 1st 1818. This being the commencement of the heavy rains on this coast, I directed the whole party into Quilon, to bring up the indoors work of the survey since its commencement in August 1816, having had no leisure since that period to bring up arrears, of which now much was to be done. A convenient bungalow as an office was built at my own expense, and the assistants...were directed to attend, stated hours being fixed for doing the indoors work.

Lieut. Conner and his party came in about the 18th inst. ...

July 20th. This evening died the assistant Perera, who came into Quilon with a fever contracted in the hilly tracts to the eastward. ... He has left a young widow whom he married in December last year. ... 21st. Early this morning attended the interment of the remains of the assistant Perera at the burial ground at Neendacurra; left Quilon at 7 a.m.

26th. Lieut. Conner who accompanied me from Quilon went on this day to Shencottah[8] for the purpose of commencing on the survey of that district. ...

31st. Arrived at the cantonment of Quilon.

The whole of the month of August within doors, examining and revising papers connected with the survey to the southward, and on the calculations of the triangles. During the greater part of the month weather stormy and rainy, and the assistants often in consequence prevented from attending office; also the papers being so very damp that they could not be meddled with without sustaining some injury.

As work went on, most of the scattered areas surveyed before 1811 were connected up and by the end of 1820 the survey was closed down. Conner was transferred to Hyderābād, and took with him all the plans and documents which he finished off at Madras, and handed in during February 1821;

[1] to SG., DDn. 156 (216, 218). [2] Sub-assistants Long and Ficker. [3] to SG., DDn. 156 (222), 12-12-17. [4] John Munro (1775-1858) Mad. Inf.; QMG. 1808 (II, 471); Resident. Travancore 1817-8 [106]. m., Madras, 1808, Charlotte, sister to Valentine Blacker. [5] Ambalapulai, 58 C/7. [6] Report of 6-3-18; MMC. March 1818. [7] MRIO. 189 (16); part of Quilon Dist., ib. 135 (22). [8] 58 H/1.

A General Map of both principalities [Travancore and Cochin]...six sheets. The northern section, including much of Cochin and four districts of the collectorate of South Malabar, has alone...been left incomplete; the insertion of the names, together with some trifling details, is all that remains necessary to perfect it.

The memoirs, registers, and routes, of each particular district will be found to accord in every particular with the instructions. ... Geographical and statistical information...will be found in the document entitled Memoir of the Travancore Survey, in which also are given some general and hasty notices as to the production, resources, population, etc., of the country. ...

Having long anticipated with anxiety the completion, ... it is difficult to repress...the solicitude we shall feel to learn the sentiments of the Surveyor General as to the manner in which the duties...have been accomplished. ... I have spoken in the plural, but in doing so will not derogate in the slightest measure from the high consideration due to Lieut. Ward. The principality of Cochin; the districts of South Malabar; part of Travancore; and the memoir of those tracts were undertaken and completed by Lieutenant Ward and myself as a joint labour[1].

In apologising for the time taken over this survey, Ward suggests that

in taking into consideration the variety of impediments presented by the mountainous and woody tracts of the east, and the dense palm groves and detailed character of the country to the west, together with the heavy rains and the climate, ... it will not appear so disproportionate[2].

Montgomerie rated the quality of the work very high;

The survey depends on Col. Lambton's triangulation, from which a minor triangulation was conducted by the Superintendent, and the points determined thereby furnished to the Assistant Surveyors. The detail was mostly taken up by means of the plain table; circumferentors, perambulator, & field books were also used [206].

This was an excellent geographical, topographical, and statistical survey, and the admirable manner in which it has been executed, and that too under no ordinary difficulties from the wild nature of the country, reflects great credit[3].

The original planetable sections of Conner's survey of Cochin are still preserved, though in fragile condition. The twelve sections are beautifully drawn, in great detail, with green forest symbols, stump-shaded hills, and clearly marked trigonometrical stations[4].

DINDIGUL, 1821

The resurvey of Dindigul had been taken up in 1815 by six assistant revenue surveyors under Turnbull[5], but progress was slow and much interrupted by sickness [II, 140]. Under his new organization Mackenzie decided to put this party under Benjamin Ward for the survey of Travancore. By the beginning of the rains of 1816, the greater part of the rich cultivated valley of Dindigul had been surveyed but "the great mass of mountains that divided the country from Travancore" remained, and Mackenzie preferred to leave this till Travancore had been completed. With the exception of Chamarett the whole party moved to Travancore between July and December, and Mackenzie reports on 26th September that

Mr. Turnbull has transmitted the map of the survey of Dindigul, which...conveys a very satisfactory specimen of these surveys, and an interesting addition to our knowledge of that part of the peninsula [II, pl. 13]. The tallook of Outampallam and two small pollams are left unsurveyed which, with part of the mountainous tract may be taken up on the close of the Travancore survey. ... The danger of sacrificing the lives of the party by persevering further in a debilitated state of health in an unhealthy country will be admitted as a sufficient reason for calling them off to another duty.

The memoirs, plans, and sections of the separate districts had been interrupted by the repeated sickness of ⅔rds of the assistants. Mr. Turnbull, by persevering in bringing up this work, with a zeal highly commendable, has...transmitted 6 memoirs descriptive of the...districts and zamindaries of Dindigul, with statistic tables of their population, cattle, etc., together with translations by himself, and by others of the assistants, of the historical accounts of the poligars of that district[6].

[1] DDn. 226 (61), 21-2-21. [2] Memoirs, M. 106. [3] DDn. 226 (51). [4] MRIO. 4-PT-19; Cochin-British Boundary, ib. 131 (1). *IO Cat.* (415), Travancore, central & north; 25 sheets, one-inch scale; Conner & Ward; Govt. Litho. Press, Madras, 1871. [5] Aikin, Pereira, Keyes, MacMahon, Chamarett, Bird. [6] MPC. 11-11-16.

On the completion of the Travancore survey Ward moved his party[1] up to Dindigul early in February 1821 and, in spite of interruptions by cholera, completed one thousand square miles of survey in six months.

The series of triangles which were carried over the whole, preparatory to the survey of the details, were...extended...from bases determined by Colonel Lambton in Travancore, and the details inserted on sections, each containing 27 square miles [II, 128].

The survey commenced in the vicinity of Periacolum[2], and was prosecuted in three different directions down the valley...embracing the valley of Wursanad[3] bordering on the Tinivelly province, and brought to a termination in the latter end of April.

The exploring of the Vurrhagerry mountains was the next and grand object in view, the survey of which commenced in the latter end of May by penetrating into them by three different passes, and with great exertion the whole of this mass of mountains was surveyed by the beginning of August, when the parties retired to Pulnay in the plains to the north...for...finishing and connecting the sections of the survey, and also to draw up such documents as will be necessary. ... This duty will occupy me within doors to the latter end of September, when I hope to transmit the whole of the materials, ... together with some original surveys ...executed by the assistant surveyors in 1815–6, received from the assistant surveyor Turnbull[4]. ...

I have been induced to embrace a large tract of interesting mountainous country dependent on Coimbatoor, hitherto never explored. ... I had it in contemplation to have extended the survey over the mass of the mountains of Dhullee...as it would complete the survey of the mountains from Cape Comorin to the Poonany River, but the excessive bad weather prevailing on those mountains...induced me to recede to the plains[5].

Montgomerie had nothing but praise for the final maps ; "The excellence of the material...renders it one of the most perfect of any of the maps of the southern provinces which have been issued from this office [120–1]"[6].

Ward had been seriously unwell all the time on this survey of the mountains, but after a month's leave moved his party to south Coimbatore in November, with the prospect of work in the Nīlgiri mountains.

NĪLGIRI HILLS, 1821–3

The first surveyors to explore the Nīlgiri Hills were Keyes and MacMahon, who visited them from Coimbatore in 1812 [II, 147–9]. They were followed in 1818 by two of the Collector's assistants who reported a fertile and healthy country at a height of eight to ten thousand feet above the sea[7], and on the strength of this report the Collector, John Sullivan[8], asked for

a rough survey, ... as "the inhabitants are extremely anxious to have their lands measured, under an idea that they are paying more than they ought to do". He obtained Rs. 300 to make the path to the hills more accessible, observing that if this were not done, the revenue ...would in a short time waste to nothing[9]. ... The formation of the road was entrusted to Mr. Macpherson [II, 428], in command of a party of pioneers, and to the same officer the survey of the lands. The road was reported as completed on 23rd May 1823. This was the old Srimugai Pass, which preceeded the Kotagiri[10] pass. ...

Captain Ward, originally one of Colonel Mackenzie's assistants, surveyed the hills, and completed the valuable memoir which...was not submitted to Government till July 1826[11].

Macpherson testifies, 12th June 1820, to the salubrity of the climate ;

My residence in these mountains has been since the 14th of March (now about three months), and probably the hottest season of the year[12]. ... So long back as 1815, I suffered an attack of the Ganjam epidemic, which appears to be an intermittent [fever] in its most malignant form, since which period...I have been subjected to occasional attacks of fever. At Madras, in December last, ... I had two attacks of ague ; in the February following at Coimbatore I was nearly brought to the brink of the grave by the same disorder.

[1] except Turnbull and the interpreter who went to Tinnevelly (II, 146). [2] Periykulam, 58 F/12. [3] Varushanad, 58 G/9. [4] Journal, MRIO. M 28 ; triangles, M 25 ; maps, ib. 133 (23–5) 146 (15) 3-PT-15. [5] Journal, 15-8-21 ; DDn. 185 ; to Mountford, 13-8-21, DDn. 192 (220). [6] DDn. 220 (201), 2-8-25. [7] from Collector to M Rev Bd., 31-7-19. Price. [8] John Sullivan (1788–1855) writer, 1804 ; Collector Coimbatore 1815–30 ; ret. 1841. [9] Collector to M Rev Bd., 6-3-19. [10] 10 m. E. of Ootacamund. [11] Grigg (280–5). [12] He appends a record of daily temperatures.

In March I ascended the Neelgherry, weak and debilitated ; in a few days my appetite was restored, and I soon recovered health and strength, since which period I have not had a single day's sickness[1].

Sullivan, pushed the development of this new health resort, and wrote to Mountford in November 1819 ;

Instructions have been issued to you to prepare a map of Coimbatoor for the use of the revenue department in that province ; ... the survey of the southern...division, made under the orders of the Surveyor General in 1812, was extremely imperfect, and...no reliance can be placed in the map which is framed from it [II, 149].

The resurvey of it appears desirable, and I am anxious...to ascertain from you whether that branch of the survey department which is now employed in Travancore could, with convenience to the public service, be employed for a few months in Coimbatore before it finally leaves the southern and western provinces[2].

Mountford replied that the Collector's old map

was not executed under the orders of the Surveyor General, but so far back as 1801–2 and 3. From the records of the office it appears to have been executed by young lads sent from the surveying school, and upon a much smaller scale than it has been thought necessary to adopt in surveys of a more recent date[3] [II, 147–8].

I perfectly concur with you that resurvey...appears desirable, ... its being so much inferior to other district surveys, particularly to the northern part of the Coimbatoor, executed since the establishment of the survey department[4]. The only objection...appears to be the delay which it will occasion in the completion of the survey of the Northern Circars [102][5].

Pending completion of the Travancore survey, Macpherson was called on to make a survey, but though he indented for instruments and received professional instructions he produced nothing of value. On completion of Ward's survey of Dindigul, Mountford recommended his move to Coimbatore and the Nīlgiris ;

The survey of the southern part of Coimbatore was executed by a few inexperienced young lads sent from the surveying school in 1801. The result of their work is in a general map in this office, and it exhibits little more than a mere sketch. On trying the work with Colonel Lambton's trigonometrically determined stations (whose operations had not been commenced at the date of the survey), its defects became sufficiently apparent.

With respect to the survey of the Nilgerry mountains, it is evident from the field books... [II,149], that the assistants (who had suffered much from fever) were induced to hurry over the work ; the climate at that time being considered extremely inimical to the European constitution. I am of opinion that...the work should be revised at the same time with the southern part of the district, especially as it ought not to occupy the party more than two months[6].

Ward started the survey of south Coimbatore in November 1821, and moved up to the mountains in March, completing field work by July 1822. He carried out the triangulation himself, whilst Keyes and MacMahon filled in the detail by planetable, thus having the satisfaction of rectifying their hasty work of 1812. An important part of the operations was the determination of the height of the plateau and the peaks, and, writes Mountford,

An area of 660 square miles has bean surveyed in the south-western quarter of this district. Lieutenant Ward intended, after bringing up...indoor work, to explore the lofty mountains on the southern frontier, and about the beginning of March to ascend the Nilgherrie mountains.

As the state of the atmosphere may...prevent Lieut. Ward...determining trigonometrically the elevation of the principal peaks of that interesting tract[7], it appears advisable that he should have the means of doing so by approximation. I have an Englefield's mountain barometer (my own) disposable for that purpose, and have applied to Government for permission to purchase another from the shops, by means of which the corresponding elevations of the mercury in the plains below may be registered.

In taking this precaution, however, I shall not lose sight of the greater dependence to be placed in the results to be obtained from the former method, if it can be obtained without undue interruption to the survey[8].

He was authorised to purchase as many mountain barometers as he could find.

[1] Grigg (Appx. lv.). [2] DDn. 148 (224), 27-11-19. [3] No record found of this early survey. [4] Triangles, DDn. 181 M. 91. [5] DDn. 148 (225), 29-11-19. [6] DDn. 192 (191), 16-7-21. [7] Highest point, Doddabetta, 8640 ft. [8] DDn. 194 (31), 28-2-22.

In July Ward reported that he had completed the survey and withdrawn to Coimbatore for mapping[1] ;

I have...taken...elevations and depressions for determining the heights of some of the eminences on that extensive mountain, but it will require some time before I can report on them. ... On descending the mountains I revisited several of my stations for the purpose of revising the angles taken in the months of March and April, the weather at that period being very unfavourable...on account of the very hazy state of the atmosphere prevailing all over...the low country[2].

During the working season of 1822–3, he completed the remaining part of Coimbatore to the east[3], and then took up survey of the Kundan hills, on the Malabar border, 15 miles south-west of Ootacamund :

In the map of the Malabar Province by the Bombay surveyors, surveyed from 1792 to 1799 [I, 131–2], the situation of these mountains forms a perfect blank and, as they resemble the Neelgherries in their prominent features, ... forming a part of that mass of mountains...and, as their western frontier forms a part of the great line of gauts,

permission was obtained for their survey. Ward carried this out himself, leaving Keyes and MacMahon to finish off south Coimbatore. In November 1823 he took three months leave owing to "the precarious state of his health", and the assistants also were given leave to the Presidency.

A reduced copy of Ward's map faces page 5 of Price's *History of Ootacamund*, and his *Geographical and Statistical Memoir* forms an appendix to Grigg's *Manual of the Nilgiri District.*

MALABAR, 1823–30

The survey of Malabar between 1793 and 1800 by Emmitt, Johnson, and Moncrieff had been carried out by radiating and intersecting route surveys, held together by a few astronomical observations for latitude. These routes had been arranged mainly for fixing the more important boundaries and communications, and in no way provided a complete or reliable map of the country [I, 131–2].

The French territory at Mahé had been occupied by the British during the war with France, and was, like Pondicherry, handed back during 1817 [97–8]. Maps were prepared from a survey made by Monier Williams in 1802 [II, 456] and older French maps[4], about which Mackenzie writes in 1816 ;

There is scarcely any difference between the English and French maps as to extent of ground. Our people then seem to have puzzled themselves & others...without any ground. In a matter, however, that may involve the national interests of two European powers at some future period, I should apprehend an accurate survey of the whole tract, including Koringotte, should not take but a few days. It is scarcely 4 or 5 square miles.

Whilst the survey of Coimbatore was still in progress, there was some discussion as to whether Ward's next task should be Ganjam, the most northerly of the Circārs, or Malabar ;

The general geography of the peninsula would undoubtedly be best promoted by employing Captain Ward and his assistants, as originally intended, in the Ganjam District. Coimbatore in all its details will not be finally completed before December, so that it would be April... before they could possibly reach the field of their future labours. ...

Experience has...shewn that a change from the southern part of the Malabar to the other extremity of the Coromandel Coast is generally attended with more or less sickness. This, however, is an inconvenience which may be felt at all times, and I...only advert to it here in reference to the smallness of the party, and to Captain Ward's precarious state of health.

By undertaking the survey of Malabar now, the party will have the whole of the next fair season from November (when the climate becomes least inimical) before them, and a very considerable portion of that district must be accomplished by the time that they could reach Ganjam. ... In a military as well as a geographical point of view our knowledge would

[1] Map of Ootacamund & plateau, 1-inch scale, 1822 ; MRIO. 136 (1) ; MRO. 253, 260 ; memoir, M 78. [2] Triangles, MRIO. M 20. DDn. 194 (105), 8-7-22. [3] Map. MRIO. 133 (1, 2) ; memoir, DDn. 185, M 537. [4] Maps by Williams, MRIO. Misc. 2-O-91 ; French map made by order of Marshal Belcombe, ib. 1-O-1778.

be much improved by the proposed measure, the present map being both extremely defective and inaccurate[1].

Ward therefore took up the survey of Malabar with his two assistants, in June 1824, but in August was granted twelve months leave to the Cape on medical certificate. George Arthur was transferred from the Hyderābād survey to take charge during his absence, but his health was poor, and most of the work, even triangulation, fell on Keyes and MacMahon. Arthur was granted sick leave to Europe in April 1825, and it was not till December that another officer, Horatio Noble, was found to take his place. Keyes died and was replaced by Malcolm. On Ward's return[2] Montgomerie writes to him ;

> It will be an object of your first care to examine and revise the triangulation on which assistant surveyors MacMahon and Malcolm have lately been employed, and you will take an early opportunity of minutely examining whatever has been executed by the last-named assistant, as there is but too much reason to doubt his accuracy. ...
>
> The Collector of Malabar lately complained of inaccuracy as to the names of villages in a map furnished to him from this office, which was compiled from materials...connected with the survey of the Cochin State [110]. ... It will be necessary that you immediately call...for correct lists of the whole of the villages...of Malabar.
>
> The survey...has hitherto met with so much interruption as to render its successful progress now an object of great solicitude[3].

To the Surveyor General he reported that

> Captain Ward, having found accomodation for his family at Tellicherry[4], resumed charge of the survey...which I hope will now be prosecuted with more vigour than has hitherto been the case, for the little progress made by the assistants during the last quarter is in my opinion too strong a proof of want of activity and zeal, for although...the assistant Malcolm had at intervals been unwell, such was not the case with the senior assistant, and I do not think that...is sufficiently accounted for in the...want of assistance on the part of the inhabitants[5].

In his report of May 3rd, Ward was

> happy to state that...the progress made during the past quarter over a very wild tract of country, though not extensive, is very satisfactory. Lieut. Noble, who commenced operations about the middle of March, ... has been indisposed the greatest portion of last month. ... He has, however, gone over a surface of 18 square miles for the short time he has been in the field[6].

Work now proceeded steadily. Wynād was surveyed during 1826–7, and connection made with the Nīlgiri triangulation[7]. Noble resigned in November 1827, and was replaced by James Du Vernet, who did much useful work during the next twenty years. Field survey and mapping were all completed early in 1830[8], when the party, strengthened by two apprentices, moved to Madura[9] [4 ; pl. 12].

NIZĀM'S DOMINIONS ; GARLING, 1816–20

The extensive dominions of the Nizām of Hyderābād had hitherto been mapped from route surveys that provided a mere skeleton of geographical information. For many years the sketches of Bussy's marches between 1751 and 1758 held the field alone [I, 115]. Then the enthusiasm of Mackenzie and Orr between 1792 and 1798 produced Mackenzie's maps of the Deccan [I, 116–7] ; De Havilland and Blair had followed from 1806 to 1810 [II, 133–4], and further information came from officers of the Quartermaster General's staff.

The geography of the Deccan had long been Mackenzie's particular interest, and it was natural that it should claim his first thoughts on his return in 1815. He chose Garling, who had held successful charge in Goa, and sent him up to Hyderābād early in 1816 with three assistants[10] to start a regular survey of the southern districts, through which Lambton had recently taken his main triangles [II, 249]. The survey was to follow the general plan developed in Mysore and

[1] Mountford to SG., 12-9-23, DDn. 200 (167). [2] resumed charge, 16-1-26. [3] DDn. 202 (321), 12-12-25. [4] 49 M/10. [5] DDn. 218 (52), 18-2-26. [6] ib. (11), 3-5-26. [7] MRO. Map 253 ; *IO Cat.* (359). [8] 22 field sections, MRIO. 6-PT-29 ; maps, MRO. 180 ; MRIO. 136 (38-47) ; 138 (12), memoir, M 14. [9] DDn. 237 (218), 4-3-30. [10] Howell, Hill, and Malcolm.

Plate 12

MALABAR

Reduced by one-third from map, scale 2 miles to an inch, from one-inch survey by Benjamin Ward and his party, 1824 to 1829 [113-4].

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Assist. Surveyor Dept.

Reg. No. 4846 HD '50-800 '51.
Printed at the Survey of India Offices (H. L. O.)

the Ceded Districts. Garling received his instructions on the 20th May 1816, and reached Hyderābād on 2nd July;

After communication with the British Resident he was...to proceed to survey the *Dooab*, or country between the Toombodra[1] and Kistna, which is recommended by the Resident as more convenient. ... The districts, Pagtoor, Rachoor[2], &c., ... adjacent to our Ceded Districts on the Toombodra, ... coming appropriately in contact with our former surveys, and well adapted for...gradual extension[3] [pls. 1, 24]. ...

The field work of the district of Alpoor[4] was completed in the beginning of August, and on 1st September [Garling] had commenced with the Godaval[5] purgannah, in which some progress had been made, tho' the increasing damp weather and other circumstances had occasioned delay. ... He expected to leave it for Rachore by the 15th of September. ... He has...experienced little difficulty, and much of an accomodating disposition in the authorities. I am hence encouraged to hope that these surveys may be with equal success attempted in the northern part of the Nizam's dominions, as soon as the completion of those in hand in the Company's districts leave a sufficient party at disposal[6] [4–5].

Work was carried on through the war of 1816–8 with a few interruptions, Mackenzie reporting on 31st July 1817;

The movements of troops and the incursions of the freebooters (March 1816) thro' the whole extent of the Nizam's country have interrupted surveys [96, 223].

Lieut. Garling, in charge of the party of 3 assistants in the Doab, reports...that he had commenced on the district of Rachoor by 9th November. The state of alarm of the country at that time...had induced him to call in the assistants, and...it was his intention...to remain for a time in the vicinity of the British posts on the Tombudra; these alarms having subsided by the middle of January, he wrote on 3rd February that he had then resumed the survey. ...

Tho' the survey of the Dooab...adjacent to our own territory appears to proceed with all possible success, yet I consider the success of...more small parties of this kind very doubtful within the interior of the Nizam's Country, until it is more tranquillized [408–10][7].

Raichur Circār was completed by the end of 1817 and with the maps Garling submitted a complete memoir, signed at Bellary on 1st August[8].

The field work of this survey was finished in December, and Captain Garling with the establishment retired, in consquence of the unsettled state of the country, to Bellary to bring up the details. In that portion of the Dooab which belongs to the Nizam there are only two Sircars, Rachore and part of Moodgul[9]; that of the Sugur, contrary to what was supposed, lying entirely north of the river. ...

Captain Garling, in addition, had been engaged on the requisition of Mr. Russell, Resident at Hyderabad, in preparing an "outline sketch of the Nizam's Territories between the Kistnah and Toongoobuddra, exhibiting their general divisions into purgunnahs, with a memoir illustrative of the same, and distinguishing the circar lands from those granted in jaghire"[10].

Sagar Circār was completed between December 1818 and July 1819[11] but Mackenzie was indignant that Garling had taken the opportunity to extend survey into Bijāpur beyond the western frontier, even though this extension was to prove most helpful to the Bombay surveyors later on. Mountford had reported that,

independently of the trigonometrical and detailed survey within the limits of the Sugger Circar, ... a series of permanently defined and accurate bases have been determined in the Beejapoor District, by which means the city of that name has been intersected, and thus its true geographical position determined[12] together with the figure and extent of the ruins of that once famous capital [II, 452].

These stations, together with those determined in Savanoor[13] by Captain Garling, will very much facilitate the survey about to be undertaken of the Poonah territories[14] [125].

Mackenzie's reply was decidedly peevish;

What business Capt. Garling has with the surveys in that quarter I cannot comprehend. I have early pointed out the survey of the Soubah of Hyderabad for that officer and, if the circumstances do not admit of his going on with that, it might be most proper to point out any other, if Government mean to continue their surveys. ... I recommend to you, Mountford, to be cautious regarding that survey. ... Captain Garling's survey should be conducted under the

[1] Tungabhadra R. joins Kistna 57 I/1. [2] Raichur, 56 D, H; 57 A, E. [3] from SG., 1–8–16; MPC. 28–9–16. [4] Alampur, 57 I/1. [5] Gadwal, 56 H/16. [6] from SG., 26–9–16; MPC. 11–11–16. [7] MRIO. M 561. [8] Memoir, ib. M 176, 181; maps, 67 (6, 7); 68 (3); 70 (74, 77). [9] Mudgul Circar, survd. 1817, copy from original sections, 2 m. to inch; MRIO. 3-PT—17; memoir. ib. M 176 [pl. 13]. [10] from Riddell, 6–3–18; MMC. March 1818. [11] Memoir, Nov. 1819, DDn. 104, M 185; map, MRIO. 70 (77). [12] 47 P/9. [13] Savanur, 48 N/5. [14] DDn. 148 (52), 26–2–19.

regular system laid down, or not at all. ... He has no business with any part west of the Nizam's frontier that I know of, and if he has gone without orders, I shall not be the man to justify it.

Beware of anticipating orders on any pretext, however plausible, and refer to me when occasion requires it [132 n.4]. ... The survey can never go on if every surveyor is at liberty to go about as he pleases. The antiquity or former importance of Beejapore is no reason. ... If that country is now wanted, there are abundance of officers willing to undertake it[1].

Field work was interrupted by

the general sickness...which had induced the superintendent to withdraw to Bellary for the benefit of medical advice. ... The assistant surveyors have been sent out to complete the field work but, ... owing to the very weak and debilitated state of Captain Garling's health, the surgeon had recommended his remaining at Bellary for a short period. ... On the completion of field work, it is the intention...to assemble the establishment at Hyderabad for the purpose of bringing up the details during the monsoon, and to concert with the Resident arrangements for the further extension of the survey north of the Kistna[2].

Mackenzie did not like so much of Garling's concert with the Resident, and wrote to Mountford ;

I have already cautioned you not to be too ready to take things on anticipation in that quarter. The proposition that he is to consult and receive orders from the Resident of Hyderabad as to surveying north of that city is also objectionable, and until he fulfils what I proposed of the districts south of it, I cannot agree. If he cannot survey the districts proposed in the Nizam's country, it would be best to employ the assistant surveyors in the Company's northern districts of Chicacole, Ganjam, etc. ; besides, I have my own plans in view for the rest of the Nizam's country, as soon as parties can be spared.

I beg, my dear Mountford, you will be careful not to go into plans thus obtruded against the proper authority of the department[3].

Mackenzie was particularly jealous on this matter because of a request from Russell for several surveyors to push on the exploration of the northern territories [83–4]. During 1817–8 Riddell had compiled a special map at Russell's request, much to Mackenzie's wrath, and the Madras Government had specially asked that both Lambton and Garling should supply Russell with as much geographical material as they could ; but, writes Lambton,

My proposal for filling up the intervals of my survey by employing young officers who are competent to act under your direction has been objected to, on the principle of its being contrary to the orders of the Court of Directors. ... Surely that Honorable body, so truly liberal in promoting everything...useful, never intended to prevent a Resident's obtaining geographical information respecting the territories in which he resides in the most expeditious way that he can : especially when such materials might be turned to account in the Surveyor General's Office. I ...hope that you will succeed with the Governor General in having as many useful hands attached to you as will give you a tolerable sketch of the Nizam's country in about four years [278][4].

Riddell also wrote to Mackenzie ;

Hodge wrote to me about the scheme of surveying the Deckan under the local authorities. He had an offer from Russell of being employed and, now that the field survey branch of the Quarter Master General's Department has ceased [II, 321–2] is placed at the disposal of the Resident[5].

Such proposals were, of course, infringements on the duties of the Surveyor General which Mackenzie could not tolerate ;

I can say nothing more regarding the Deckan map till I get copies of the correspondence ; I am sorry it went beyond its mark, as I conceive a bare copy of what was in the office was sufficient. This was the only point in which poor Riddell departed from my instructions, and he wrote me it was in consequence of a private letter from Mr. Russell[6]. ... It was a great error to think of compiling a map in the office in Madras which was not known in the primary office, and entirely contrary to the intention[7]. ...

The difficulties...at Madras, and also with the only surveyor in the Deckan under my orders originally, have of late increased, particularly that of Hyderabad, where the surveyor seems to be acting independently...and, I am concerned to add, by the authority of the Resident, who seems to have taken on himself the direction of this survey, a measure I should have officially remonstrated against...did my health permit me to go into so unpleasant a detail.

[1] DDn. 149 (51), 23–3–19. [2] from Mountford, 18–6–19 ; DDn. 148 (19). [3] DDn. 149 (78), 4–9–19. [4] ib. 92 (43), 21–5–18. [5] ib. 151 (192), 10–6–18. [6] ib. 149 (19), 16–11–18. [7] to Mountford, DDn. 149, 2–1–19.

Be so good as to communicate this where it may be necessary ; ... I long ago stated my opinion of the consequence of the unusual application of Mr. Russell to have the surveyors put ...under his orders. ... The surveyor, who has been opposing my orders and instructions for a long time [has been] proposed by Mr. Russell to be sent to another quarter. The moment I am well enough I will officially remonstrate...and...propose the most obvious remedy for a surveyor disobeying the orders of his principal[1] [304].

Mackenzie's patience was completed exhausted when he heard that Garling had undertaken a survey of the western boundary on Russell's request[2]. This stretched over 700 miles from Afzalpur on the Bhima River, northwards to Ahmadnagar, and occupied from October 1819 to June 1820. Garling himself ran a net of triangles along the whole line, whilst one of his assistants surveyed the boundary and the villages on either side of it. Some of the detail survey was effected by "a private draftsman", A. D'Houlbee, engaged by the Resident[3].

Mackenzie writes indignantly to Metcalfe, who was shortly to succeed as Resident, complaining of

the removal of Capt. Garling from the quarter recommended by me...to a survey of limit, which might have been defined in a very short time by any competent officer of the troops employed in that quarter. I know that country, & I know positively that there was no necessity for removing Capt. Garling to that duty. ...

Capt. Garling has followed this by plans entirely opposite to mine, ... a deliberate attempt to perplex & retard what I had submitted in 1816. ... I wish to know whether Mr. Russell was authorised to break up the...survey, & to apply its establishment to a plan of his own[4].

There is no reason to think that Garling had the slightest intention of flouting the Surveyor General's wishes, and it was natural that he should look to the Resident for guidance in the details of his programme. Mackenzie's ill-health was largely responsible for this bitterness. He admits that he had several letters from Garling lying unread ; he refused Garling's request for leave to come and see him in Calcutta on the grounds there was no officer available to act for him[5].

The party was pursued by bad luck ; Terry died in 1819, and Garling himself died in June 1820. Mackenzie was aging—his health broken—and he also died, the following year.

HYDERĀBĀD SURVEY, 1820–3

After Garling's death mapping was carried on under Thomas Hill, the senior assistant, till in October 1820 Mountford called him down to Madras. After handing in the Travancore maps, Conner took over charge, and on the march up to Hyderābād the whole party "suffered considerably from fever and from the epidemic. Within a month of reaching Hyderābād Conner died, 29th April 1821.

Robert Young [II, 320] was appointed to succeed but did not take over charge until December, and in the meantime Hill carried on the mapping with four assistants[6], and took up field survey in the districts west of Hyderābād ;

There were three maps compiled by us ; one containing the Nizam's western boundary, surveyed in 1819 and 1820, which is completed and is now in possession with the Resident, Mr. Metcalfe [II, 471][7], for transmission to the Governor General ; the other two, containing the whole of the surveys in the Nizam's territory on a scale of 8 miles to an inch, one of which was thoroughly completed and taken to England by the late Resident, Mr. Russell, when he left this for Europe [291] ; the other, with copies of all the road surveys in 1820, are in possession with a Lieutenant Burr [281] of the Russell Brigade for completion[8].

Mountford reports in November that,

Although the officer appointed to the charge of this survey has not yet joined the party, considerable progress has nevertheless been made. The long experience of the head assistant, Mr. Hill, ... has enabled him to carry on the work in all its details without interruption. The reduction...to the scale of 4 miles to an inch, and the original sections of the survey, have

[1] to an officer in Public Dept. Madras ; DDn. 154 (93), 10–8–19. [2] Memoir, DDn. 183, M 173 ; Map, MRIO. 68 (3). [3] 15 planetable sections, MRIO. Misc. 5–O–19, with 5 fair sheets, and reductions ; ib. 5–O–19 & 20. [4] DDn. 156 (278–80), 25–1–20. [5] DDn. 149 (35), 20–8–19. [6] Chamarett, Bird, Long, Ficker. [7] relieved Russell, Dec. 1820. [8] DDn. 147 (241).

been brought nearly to a close. Captain Young had proposed leaving Nagpoor (provided he could get relieved from the charge of the pay office), on the 20th instant[1].

Young actually left Nāgpur for Hyderābād on 4th December, and in January took the party east of Kurnool to an area covered by Lambton's triangulation of 1811–12 [II, 245–6], a choice which appeared to Mountford "to be very judicious and proper". Lambton wrote from Ellichpur

to my sub-assistant Joseph Olliver who is now at the French Gardens [II, 394 n.11] to supply ...a sketch of the triangles. I am not sure whether the elevations of the stations above the sea have yet been computed, but, if not, you shall be supplied with them as soon as they are[2].

By February 1822 an area of 2,205 square miles, surveyed since Conner's death, had been fair mapped, and Mountford reported that

Captain Young and his party commenced their operations on the 13th February, and by the end of the quarter an area of nearly 1200 square miles had been surveyed, notwithstanding the prolonged indisposition of Assistant Surveyor Hill. The greatest part of the work has been protracted on a scale of 2 miles to an inch, and some progress has been made by Mr. Hill in reducing it to the scale of Arrowsmith's map [288].

It is Captain Young's intention to push on the field work towards a junction with the tract surveyed last year, but I apprehend he will not be able to prolong his stay in the field beyond the middle of June, which is the usual period for the setting in of the rains[3].

The party continued to make good progress up till 6th April 1823, and covered part of Daverconda Circār[4], though Young "was driven to quarters by an attack of the liver". The same month the assistants were brought into Hyderābād, Young reporting that

the course of the Kistnah has been explored from latitude 16°, longitude 78° 20′ 19″·4, as far as a chain of mountains almost impenetrable except to the Chenchooars, a tribe of Hindoos inhabiting these wild and gloomy tracts. The full area reported surveyed during the quarter was nearly 29,000 square miles[5].

He was granted five months sick leave, but died at Masulipatam on 2nd July. George Arthur had been appointed assistant in anticipation of this leave, but Hill took charge once more until the arrival of John Crisp [II, 321].

HYDERĀBĀD SURVEY, CRISP, 1823–7

Crisp took over charge in September 1823, finding that Arthur, Hill, Ficker, Chamarett, and Britain, had spent the rains on arrears of mapping and a survey of cantonments.

Under Crisp's charge they now completed the area to the south-east, as far as the Kistna and including the country round Khammamett[6], and in 1824 moved west towards Gulbarga. Arthur was transferred to the Malabar survey in September 1824, and in February 1825 Crisp reported that "although two of his ablest assistants have been laid up by attacks of fever" the party had surveyed about 3,500 square miles during the past quarter.

About this time Montgomerie pointed out that though a large area of the Nizām's southern districts had been surveyed, mapped, and described in detailed memoirs, yet the material was not arranged in orderly manner by circārs, the regular administrative divisions. Blacker, Surveyor General, decided that, in view of the many changes, it would be well to suspend field operations for a year, in order that Crisp might bring the records up to Calcutta, and re-arrange them in orderly fashion [121]. The party was therefore withdrawn to the Presidency, and Crisp moved to Calcutta in November 1825, being joined there by Thomas Hill[7] with the records. Twelve months later he had reduced the surveyed area to a map on the scale of 16 miles to an inch[8], and had systematized and compressed

the...records, which embrace indiscriminately a large tract...surveyed at different periods, into distinct form and arrangement of circars.

[1] from Mountford ; DDn. 192 (287), 28–11–21. [2] DDn. 184 (175), 28–1–22. [3] DDn. 194 (83), 30–5–22. [4] 56 L/14. [5] DDn. 200 (62), 1–5–23. [6] 65 C/4. Maps, MRIO. 70 (88, 99–105). [7] sailed from Madras 8–2–26. [8] Sketch shewing area surveyed 1821–5 ; south of 17° 25′ and east to 80° 15′; MRIO. 67 (17, 30–2).

Of the fifteen circars, or provinces, which have come under the operation of the survey five only are completed, viz., Raichoor, Moodgul, Süggur, Pangull, and Ghirnapoor. The three former, executed and modelled by Captain Garling according to the provincial arrangement, are already in deposit at the office. The two latter are herewith submitted in the accompanying volume. ... From the same original sources I have separated and compiled all that relates to the remaining ten, and propose immediately on joining my station to complete and forward them in succession.

As myself and my assistant Mr. Hill are now prepared...to rejoin the Hyderabad survey party in the field with all possible expedition, I propose sending Mr. Hill by the first opportunity in December to Masulipatam, but I...crave...to postpone my own departure until January[1].

The party re-assembled at Hyderābād during January 1827 for field work in the circārs of Golconda and Daverconda[2] [pl. 18]. In April Crisp resigned in order to take up another appointment, and was succeeded by James Webb.

HYDERĀBĀD SURVEY, WEBB & MORLAND, 1827–30

Webb took over in May 1827, finding Hill, Chamarett, Long, and Britain, and receiving the following instructions;

Sixteen circars in whole, or in part, have come within the operations of the survey north of the Bheema and Kistna rivers; two only are complete in their memoirs, Ghunnapoor and Pangul. The memoirs of the other circars will...be completed...when they shall be finally surveyed. It would appear from Captain Crisp's letter...to have been his intention to complete the survey of the Golkonda and Daverkonda circars, but, as...portions of the circars of Bonaghier and Nelgoondah may fall within the operations of next season's survey, you should make your arrangements accordingly, and...for extending the survey the following season to the eastern limits of the Nizam's dominions[3] [pl. 18].

In March 1828, Henry Morland, who was to be connected with the Hyderābād survey for the next twenty years, joined the party as assistant, reaching Khammamet via Masulipatam [5, pl. 13 n.]. Progress during the past season had been poor and Montgomerie sent Webb a tickler;

The very limited extent of country that has been surveyed by your party since taking the field in October last being so far below the average...executed by the same assistant surveyors in 1825, I am compelled to call on you for an explanation.

This was applauded by the Surveyor General, Hodgson; "You did right in giving the Hyderābād assistants a rule; they certainly are not over-industrious, and require keeping to their duty"[4].

Work was closed on the eastern frontier, and connection made with Snell's survey [102]. Early in 1829 Morland, with Hill and Long, surveyed about 1,100 square miles of Palnād, which had now become part of Guntūr [97–8]. Webb took sick leave to England in July, leaving Morland in charge, and Montgomerie reports;

27th October 1829. The party in the Nizam's Dominions is now rather strong, and in a short time I hope will be very efficient. Lieutenant Morland, lately appointed to the charge, has not had much practice in surveying, but, from the manner in which he acquainted himself during last season, I have reason to hope that he will conduct the survey with success.

Lieutenant Dardell, lately appointed assistant officer...is on his way to join the party which is now employed in the Maiduck Circar[5] [pl. 13]. The remainder of the party consists of 4 assistant surveyors, 1 sub-assistant, and two apprentices lately joined, whom I consider sufficiently qualified for field work. Mr. Hill, the senior assistant surveyor, has been suffering from dropsy for some time past, and will, I fear, have to be transferred to the pension establishment. The records of the survey of the Bonghier Circar...have lately been received[6].

20th October 1830. The Hyderabad party took the field in the beginning of the month; it will be employed in...the Warungul Circar[7] until about the commencement of the hot weather, when it is Lieutenant Morland's intention to endeavour to complete the survey of the Kummumett Circar. As a considerable portion of the tract...is considered unhealthy...I have applied ...that an assistant apothecary may be attached to the party[8].

[1] DDn. 147 (356), 30–11–26. [2] Map, MRIO. 70 (99). [3] DDn. 222 (117), 25–5–27. [4] DDn. 231 (156), 8–7–28. [5] Medak, 56. J. K. MRO. map, 528, from original sections one-inch scale [pl. 13]. [6] Map, Bonaghur Circār, MRIO. 70 (82), DDn. 238 (135). [7] 58 O/NE. [8] DDn. 237 (245).

27th October. The assistant officer, Lieutenant Dardell, was never before engaged in survey, so that his time was mostly occupied in receiving instructions last season. He will take a share in conducting the minor triangulation[1].

Amongst other maps the India Office catalogue shews,

Skeleton plan, exhibiting the whole tract surveyed in the Nizam's dominions, from the commencement in 1816 to the present time, ... 17th July 1830, scale 16 miles to an inch [pl. 24].

Hyderabad topographical surveys, scale one inch to one mile.

The first portion of the surveys was made in separate circars, and drawn on small sections, measuring 14 inches by 7 each, including on each section 12′ of latitude and 6′ of longitude [II, 128, 215, 229 ; III, 206]. The subsequent survey was carried on continuously, and drawn on paper of large and varying sizes[2].

PROFESSIONAL REVIEWS, 1824–30

Frequent reference has been made to comments by Duncan Montgomerie, who succeeded Mountford as Deputy Surveyor General in July 1824. After the usual course at the Military Institution [II, 321], he had been employed with Mountford on maps that were greatly admired for their beauty and clearness [II, pl. 12 ; III, pl. 11]. He was for a short time surveying on the Nāgpur—Hyderābād borders [83–4] and later in the Marātha Deccan [125], and he obviously had outstanding talents, for Mackenzie had for some time been anxious to secure him for charge of a field party. He recommends him to Malcolm for employment on the map of Mālwa [84, 267], as

an officer who stands on my books...on account of the great satisfaction he gave in reducing the whole surveys of our Military Institution, in concert with another officer who has been already provided for [Mountford]. ...

The beautiful and satisfactory specimens of Mr. Montgomerie's drawings, and his character, induces me to recommend him ; ... he is now with his regiment at Ellore, and I write his Colonel, ... who is much interested in him, that I have taken the liberty of recommending him to you. ... I enclose an extract of letters regarding Lieutenant Montgomerie, whom I never saw ; the specimens of his drawings in maps are indeed beautiful[3].

He mentions him in several letters to Mountford during 1818–9, for example ; "Mr. Montgomerie, I conceive, had the first claim to be employed. ... There should be some remembrance of former service"[4].

Within a few months of his appointment as Deputy Surveyor General, Montgomerie suggested that the older district surveys should be brought into line with the later surveys based on Lambton's survey, for their better incorporation into the new Atlas of India [194]. Blacker replied ;

The districts of Tinnevelly, Madura, Dindigul, Trichinopoly, Tanjore, and Poodoocotta, are represented to be those which have been thus imperfectly surveyed [II, 139–51, 162], and it will be proper that you should suggest to Government the employment of a certain number of qualified officers to extend a plain triangulation, when necessary, between Col. Lambton's points[5].

Blacker also sent him a sketch by Mountford shewing progress of the surveys ;

I am desirous of receiving as early as possible a new sketch with the same view, but modified ... to exhibit those portions of the country which may be considered as "finally surveyed". The leading principle of this classification will refer to...the Great Trigonometrical Survey, which will be considered to include all Lieut. Garling's triangulations.

Colonel Mackenzie's survey of Mysore, although not grounded on the Great Trigonometrical Survey, will also be considered final ; so will all such...surveys as have been proceeded by, ... or...subsequently corrected on, indubitable triangulation. ... Much of the revenue survey will have to be struck out, ... but should there be any detailed surveys in which you may repose confidence...you will...exercise your discretion as to including it under "finally surveyed"[6].

On receipt of Montgomerie's report, Blacker asked whether

those surveys which you consider "finally surveyed" are complete in all their records, and that these are preserved with so much care as to be...immediately accessible to reference. ... I

[1] DDn. 237 (249). [2] *IO Cat.* (282–3) ; GBO. museum, original 4-inch svy. Secunderabad cant., 1828.
[3] DDn. 154 (7), 7–9–18. [4] DDn. 149 (49), 4–3–19. [5] DDn. 220 (51), 5–8–24. [6] ib. (52), 3–9–24.

Kothapully
Chin Cheekoad
Yadawaru
Seeregada
Poorsutpully
Atchmapully
Somawarum
Kumerpully
Pedda Cheekoad
Beebeepett
Ragwalapully
Ramreddypully
Chettapoor
Ramakapett
Letchapett
Doobak
Doompulpully
Chowderpully
Charapoor
Chittapoor
Dermawarum
Boompully
Kasalabad
Murdhod
Veerareddypully
Jungapully
Almaspully
Kondapoor
Cheypul
Alwal
Ibrahimpatam
Nazulapully

NIZĀM'S DOMINIONS

Reduced from one-inch survey of Medak Circār, season 1829–30, by Hyderābād survey party under Henry Morland [119]. Shows Mānjira River, flowing north towards Medak, 50 m. north of Hyderābād.

The tanks are often dry.

The topographical survey of the Nizām's Dominions was commenced in the extreme south-west under James Garling in 1816 [115] and continued with occasional breaks till 1855. Henry Morland held charge for more than twelve years between 1829 and 1848.

H Morland Captain
in charge Hyd Survey
R.L.
W.H.T.

(Assistants Long and Turnbull)

Reg. No. 4087 HD'47-800'52.

Printed at the Survey of India Offices (H. L. O.)

consider...any plan as unworthy of confidence when the records are either missing, unsatisfactory, or incomplete [I, 225], and...therefore...class under the head of "requiring to be re-surveyed" the tracts comprehended in Captain Beatson's map of the Palnaud District [I, 110; III, 96], and Captain C. C. Johnson's map of Nellore and Ongole districts [II, 149].

The insular parts...on the borders of the Military Institution's survey require to be surveyed, and the portion of the Madura and Trichinopoly districts...should be surveyed at the earliest opportunity, after which, and the extension of the Malabar survey through Canara, with the small districts of Punganoor and Venkatyghurry Kotah[1], the topography of the southern parts of the Peninsula would appear to be complete[2].

Montgomerie then submitted a full review of all the surveys shewing the extent to which original documents and memoirs were complete and Blacker asked that these should be brought up-to-date for all surveys then in progress;

I am fully aware field operations may be partially interrupted by the duty...which I consider paramount to all others. You report the deficiency of memoirs of surveys whose plans are already in your office, and which may therefore require to be surveyed over again. It is consequently evident that the written registers and descriptions, not the plans, are the essential results of the operations of a survey, and that if they are not satisfactorily prepared, the expences of the survey may be considered in a considerable degree nugatory[3].

On these orders both the Hyderābād and Vizagapatam surveys were closed down in 1825 [102, 118–9], whilst Montgomerie made that critical review which has been frequently quoted, and on which the future programme was based.

In January, 1827, after discussing with Hodgson what material was fit for incorporation in the atlas [120, 284], Montgomerie addressed the Madras Government regarding the

state of this department, both as relates to the immediate duties in the office, and what has yet to be accomplished in the field. ... The drawing establishment is now strong, and...the parties in the field are weak. ...

The surveys executed under this Presidency since...1810, accompanied by ample memoirs and comprehensive statistical accounts, are not surpassed by those of any other country[4]. ...

The surveyors...have no doubt possessed a great advantage from the Great Trigonometrical Survey, either as the foundation of the late surveys, or as the means of verifying those which had preceded it. ... [Of] the diversified features of the country, being in general favourable for an elegant topographical delineation, every advantage has been taken...by the insertion of the minutest details.

But, highly valuable as these surveys undoubtedly are, the operation by which they are obtained is very tardy. ... Five years were taken up in surveying that portion of the Nizam's dominions north of the Kistnah[5], ... and although the party in that quarter has for some time been stronger than either of the other surveys, yet, unless it be considerably increased, the prospect of a final completion of that survey must still be distant.

The survey in the Northern Circars, with which there is now only two assistants of the old revenue surveying school, has nearly reached Vizagapatam, so that a considerable portion of that district, and the whole of the Ganjam District, remains to be surveyed, and...the operations of the surveyors are slower than in the Nizam's territories, while in that quarter we have not the advantage of the operations of the Great Trigonometrical Survey.

The survey of Malabar has now also only two assistants remaining of the old revenue surveying school. This survey is considerably advanced, but with the present strength...it will require two or three years more before it can be brought to a close. ...

Much yet requires to be done before the territories under this Presidency can be considered as finally surveyed[6].

Montgomerie again put up a very full review in 1833, before resigning from the post of Deputy Surveyor General[7].

[1] Punganuru, 57 K/11; Venkatagiri, 57 O/9. [2] ib. (60), 8–12–24. [3] ib. (87), 4–8–25. [4] fully appreciated by Everest, DDn. 238 (8), 12–1–32; by Waugh, DDn. 665 (37), 5–9–54; cf. Jervis (26). [5] 16,237 sq. miles from 1821 to 1825 DDn. 202 (295). [6] DDn. 222 (2), 12–1–27. [7] BM Addl MS. 14380 (103–7).

CHAPTER IX

BOMBAY SURVEYS

Military Routes — Khāndesh, 1821–2 — Marātha Deccan, 1817–30 — South Konkan, 1819–30 — Kāthiāwār, 1822–5 — North Konkan & Gujarāt — Trigonometrical Surveys, 1819–30 — Cutch & Sind, 1825–30.

AFTER the abolishment of the post of Surveyor General at Bombay from 1st March 1815 [II, 306], Monier Williams was retained in charge of the revenue survey of Broach, which was eventually extended to other districts of Gujarāt [170–1]. He also maintained a drawing office employed mainly to revise Reynold's map, and take copies of any areas required [II, 284–5 ; III, 280]. Fresh material was constantly coming in from surveyors who were not always under his orders, for he had little or no concern with the military surveys and reconnaissances made during the war against *pindāris* and Marāthas.

Of these military surveys, reference has been made to those of the passes through the Sātpura range and along the eastern limits of Gujarāt, that were made in 1816 by Johnson, Sutherland, and their assistants [83]. Pending their completion Williams supplied,

from the materials and information in my possession, a sketch of the whole eastern frontier of the Province of Goozerat, with the bordering portions of Khandries, Malwa, Meywar, and Marwar, with a paper of remarks, both being intended to illustrate the degree of security derived...from the nature of that frontier, which I conceive to be the object of the survey allotted to Ensign Jervis [II, pl. 15][1].

Johnson, now Quartermaster General at Bombay, was sent up to Poona at the end of March with Jopp and Macleod, and directed

to ascertain the best means of...impeding the passage of the Pindaris through the Peishwa's country, and the best routes for...the pursuit of those marauders. ...

The range of hills most important to be known soon is that in which are the ghauts of Adjuntah[2], Cossabarree, and Chandore. It is also desirable to know the western ghauts by which the Pindarees might descend from the Deccan into the north of the Concan, and through that into the Attaveessy[3] [169]. The limits of your survey...would be from the Amba Ghaut, west, to the junction of the Adjuntah range with the Western Ghauts, and from the junction southward to the Bore Ghaut[4].

The next range to be attended to is that on the north of the Taptee, through which the Saindan pass runs ; ... that to the north of Ahmednuggur...may be surveyed ; and...these surveys...should be incorporated with the general map of the country[5].

Sutherland's task lay further north, and he reported in June that he had completed the survey of the Sautpoora mountains as far as Boorahaunpoor, as minutely as circumstances would permit, crossing the Taptee at Barkumcondah, and commencing at Doonu Bhawke Ghaut. The country...was almost in a state of insurrection, and principally belongs to Holkar and Scindia. The rains have now commenced and it is my intention to recross the Taptee before it becomes impassible, and proceed to the examination of the western range, through which there may be passes leading into the Attaveessee[6] [II, pl. 15 ; III, pl. 9].

By October he had

completed...the survey of the...passes...leading through the western range into the Attaveessee north of the Bhaura Ghaut[7]. ... It is my intention to continue...without delay, ... having just received a letter from the Hon. Mr. Elphinstone approving of my commencing at the Bhaura Ghaut. ...

[1] George Jervis, assistant to Sutherland. BSC. 14–9–16 (1). [2] 46 P/10, 14. [3] Atavisi covers 28 subdivisions between Kim and Damānganga rivers, E. & SE. of Surat. [4] Borghat, 47 F/5 ; pass W. of Khandala, where Poona–Bombay road and railway cross W. Ghāts., *Imp Gaz.* IX (5). [5] from Elphinstone, Resident with Peshwa ; B Pol C. 11–5–16 (38). [6] ib. 3–8–16 (7). [7] Map, MRIO. 124 (27).

> The desolated state of the country adjoining the Sautpoora mountains, the character of the Bheels and of their chiefs, and the sovereignty...existing for the most part in the Holkar family, prevented my carrying the line of survey so near the hills as I could have wished. ... I penetrated to the foot of..."Dootea Bawaka Ghaut", ... the most western passage through these mountains, ... of so difficult a nature that even a single horseman passing over it is obliged to dismount[1].

Routes were also surveyed through the Atavisi by Adams, Towsey, Ovans, Newport, and Lenn[2]. Another military survey was carried out by Remon and Jopp with a small force[3] on the borders of Gujarāt and Cutch during 1815–6, as "the spontaneous undertaking of these two officers"[4]. Valuable surveys made in Mālwa by Frederick Dangerfield[5], were embodied in Malcolm's map [84–5, pl. 9]. He later spent about two years on a geological survey of the same area [267].

Much interest was taken in the Narbada River, not only as regards its upper course [84–5, 88–9], but also regarding the navigability of its lower reaches, and surveys were made by Hansard, Mathias[6], and Syme [84–5]. It was found unnavigable

> from the Hern-pahl, or Deer's leap (as it locally termed from the narrowness of the channel), where it enters the broken ridges of the Satpura range, to...a short distance above Tulluckwarra[7]. ... Mathias...in April [1820]...was able to go from Mundleysir to the Hern-pahl in a small craft, ... and from Broach to Tulluckwarra in a boat of tolerable size[8].

In 1822 Thomas Elwon of the Bombay Marine made a more detailed survey, being supplied beforehand with a map prepared in the revenue survey office at Broach, scale 1½ inches to a mile[9].

In April 1829 Edward de l'Hoste, failed to get up to "Hern-pahl", but "ascertained that there was no difficulty whatever in proceeding...to Rulluckwarra, and also that with very little trouble water-carriage could be procured from Rulluckwarra to Broach"[10].

In 1840 further attempts were made to navigate the river and a "trial made between August and November to transport coal by rafts from Hosungabad was a total failure". A further attempt was made in 1847. A reduction of a special map compiled in the Surveyor General's office was published by the Asiatic Society in 1844[11].

KHĀNDESH, 1821–2

It was some years before adequate maps could be provided for the vast extent of territory acquired by the Company in 1819 at the conclusion of the Marātha war. Sutherland was given the survey of the southern Deccan which had formerly belonged to the Peshwa, but his officers were few and the country wide. There were no adequate maps of Khāndesh, a wild and sparsely populated area covering the valley of the Tāpti, till John Briggs, a Madras officer with some previous knowledge of surveying, and Political Agent from May 1818, prepared a useful map during 1821–2 ;

> Only some imperfect and incorrect maps were in existence, which had been used by the commanders of our troops in the former Mahratta war of 1803. A very few points of longitude had been determined by celestial observations.
>
> Two English officers were sent to me in 1818 to complete this desirable object, but both of them very soon contracted the malignant intermittent fever so prevalent on the outskirts of the hills, and had to go away on sick leave, and the Government declined to send others.
>
> I then procured instruments from Bombay selected by a scientific friend and, with my own knowledge of surveying, I was enabled to direct...three young engineer clerks, whom I engaged as my assistants. In the course of two years I produced a complete map of Khandesh which, together with the field books and map of triangulation, I submitted...to the Bombay Government which, on ascertaining the value of the work by sending professional surveyors to verify

[1] Sutherland's maps, 3 m. to inch, drawn by Slight ; MRIO. 127 (27–8) : see also ib. 124 (5, 6), B Pol C. 7–12–16 (9). [2] DDn. 278 (33–7). [3] under Col. East. [4] Bo MC. 8–1–17. [5] MRIO. 84 (14–8) [pl. 9]. [6] Fdbks. MRIO. M 401 & DDn. 161 (17). [7] Tilakwada, 46 G/9. [8] *Bo Geo Soc.* I (177). [9] MRIO. 161 (13, 14). [10] *Bo Geo Soc.*, I (174), Bo MC. (camp), vol. 59 (122–3, 130–1), 19–5 & 18–7/22. [11] *JASB.* XIII, 1844 (495–579) ; XIV, 1845 (lxix ; 354–6) ; XVI, 1847 (1104–12) ; XVII, 1848 (210–21).

its correctness, re-imbursed me for the trifling expense that I had incurred. That map was lithographed in Bombay, and has been included in the trigonometrical survey of the Deccan[1] [125, 130].

The officers who joined Briggs in 1818 have not been identified, but two of his surveyors were Arthur White [275] and James Evers. The map was on scale 3 miles to an inch, and was

constructed on a series of positions by cross bearings taken with a circumferentor on stand, made by Adams, London [II, 459], with a telescope and hair sights, from a base-line of 2 miles in length...measured by a ten-foot wooden rod on levels taken for the purpose.

The intermediate parts of the map, where places could not be seen by the person carrying on the trigonometrical survey, were filled up by measured routes and bearings made with a perambulator, a brass 100 ft. chain, and small circumferentor. The object has been to include every village, inhabited or uninhabited, but some of the latter were not to be found[2].

The original was sent to the Directors in 1838, together with a compilation adjusted to Shortrede's trigonometrical points, it being pointed out that

there are no maps of Kandeish and Konkan...at the Presidency available for compilation. Such as have been received from Bombay in June 1835 prove to be mere rubbish, having neither lines of latitude and longitude, ... altogether unworthy of compilation for the Hon'ble Court, being surveys of 1821 and 22, executed under the superintendence of Captain Briggs[3].

In 1850 Waugh reported that on comparing Briggs' map with others, distances were found too large by 15% to 20%, but "whatever may be its faults, no better detailed survey of this part of India is forthcoming"[4].

MARĀTHA DECCAN, 1817–30

After Sutherland's survey of the passes through the Sātpura range, he remained on survey under Elphinstone, who was definitely map-minded [1], and in May 1817 called for material then available in Bombay ;

The survey of the Peishwa's dominions under Captain Sutherland being now in progress, it becomes of importance to ascertain what parts of the country have been already surveyed, and likewise to embody all the information in the possession of Government in one map. ...

Information is now required—towns & forts—products and characteristics of the country—as well...as maps. ... I attach peculiar importance to any information regarding the Paishwa's forts. ... I am anxious for any maps or information regarding the Conkun [129], which is full of strong places, & is a blank in all our maps. ...

The maps...should be on a large scale, so as to comprehend the smaller villages. It will be practicable for the surveyors to fix the positions of the principal places, but the time requisite for finding out the smaller ones...may easily be saved by copying them from former sketches[5].

The following year Munro reported from Hubli[6], near Dhārwar, that,

as all our maps of the Southern Marrahtta Provinces are extremely defective, and as considerable inconvenience was experienced from this cause during the late campaign, ... a correct survey of these provinces should be made as soon as possible.

Such a survey is required, not only for...geographical knowledge and military purposes, but also...to attain an accurate idea...of the territories of the different jageerdars, and to guide us in arranging such exchanges of territory with those chiefs as may hereafter be found expedient. The sirkar and jageer districts and villages are so intermixed that without a survey it will be impossible to ascertain whether any proposed exchange will be advantageous or not[7].

Elphinstone strongly supported Munro's request ;

A survey of the country conquered from the Paishwa is already in progress under the direction of Captain Sutherland, ... but it would greatly expedite this...if...as many officers qualified to survey, as can be spared, ... be placed at my disposal. ... Such officers...should be ordered to Hoobly...under the orders of General Munro[8] [5–6].

Madras was asked to lend experienced surveyors—Mackenzie sent sample maps and memoirs of his surveys of Mysore and the Ceded Districts—and in December 1818 Elphinstone directed Sutherland

[1] *Briggs* (82). [2] Note on map sd. by Briggs ; MRIO. 127 (3, 4) ; *IO Cat.* (438). [3] James Bedford to SG., 11–9–37 ; DDn. 362 (72). [4] *PR.* (38), 15–4–51. [5] from Poona, 2–5–17 ; Bo SC. 14–5–17. [6] 48 M/3. [7] MMC. 23–12–18 ; DDn. 133 (426), 11–7–18. [8] MMC. 23–12–18.

to undertake the survey of the country east of the Ghauts, from the Satpoora hills to the Toombuddra[1], for which purpose you will be supplied with such assistants as you may require, Lieutenant Jopp and Ensign Slight are already under your orders[2]. I shall apply to General Smith[3] to place Captain Challon also at your disposal and, in the event of the compliance of the Government of Fort St. George, ... those officers also shall be under your orders. ...

The present survey should be full and accurate, and sufficiently minute to supersede the necessity of any other survey, except a revenue measurement which may hereafter be executed, perhaps by natives under the control of an European officer, and under the direction of the Collectors [171–2].

You are in possession of such fragments of the survey formerly made under your management as have been saved from the Residency[4], and...of the map drawn up by Lieutenant Colonel De Havilland [II, 133], and that furnished by the late Surveyor General of Bombay [125].

These maps, and the printed ones, will shew you the least known parts of the country with which it is desirable you should begin, but they will not...supercede the necessity of your going over the whole country as if nothing had yet been done. When it can be combined with the principle of beginning with the least known parts of the country, and with your own general plan, I beg you would...accommodate your arrangement to the wants of the civil authorities. ...

To ensure the completeness of the survey, ... it should be made by pergunnas, the boundaries of each...to be surveyed, and the contents filled up, before proceeding to another. ... Caution may be observed in avoiding any enquiries likely to alarm the natives by suggesting the imposition of new taxes, or alteration of any of their established usages[5].

Not only did the Madras Government lend officers[6], but they also provided instruments, and copies of Garling's triangulation and topographical surveys [115];

Captain Garling has reported that during his convalescent state at Bellary, he had with the assistance of Thomas Hill been occupied in the preparation of materials which may be useful to the surveyors of the Southern Mahratta States. They consist of a plan upon a scale of 8 miles to an inch, exhibiting the trigonometrical stations...of the surveys executed by him in Goa, Soanda, the Doab[7], and the Suggur Circar—a register of the above shewing the angles and sides—a sketch upon a scale of one mile to an inch of part of the western limits of the Suggur Circar—a descriptive memorandum[8].

The triangulation of the southern area [129] was carried out by Jopp whose close co-operation with Garling was not smiled upon either by Mackenzie or Sutherland [115, 129].

In June 1820, Sutherland reported that

the extent of...the late Peishwa's territories...may be estimated to contain 58,190 geographical square miles, 15,000 of which have been minutely surveyed, and 16,000 partially traversed, the latter only requiring a few months labour to complete, which, with the remaining portion ...to be surveyed, will...occupy two years more to ensure a useful and accurate map of the conquered territories. ...

Since the first commencement of the survey, many unforeseen obstacles have impeded its prosecution, independent of the losses sustained at the breaking out of the war of all the materials...previously collected [*sup*], the deranged state of the country during its continuance, ... and...the frequent interruptions from some of my assistants having been employed on other duties, and others from a want of the means, health, and experience, being unable to take an active share in the survey.

I have just been deprived of the services of Captain Challon, whose indefatigable exertions have contributed so much to the advancement of the map, and likewise of Captain Boles and Lieutenant Montgomerie[9].

A request to Madras for the loan of two or three country-born assistants produced only James Aikin, transferred at the close of the Travancore survey [375, 386][10].

On Sutherland's appointment as Assistant Surveyor General, in 1822[11] [323], he handed over to Jopp, who in April 1823 had nine assistants[12] besides Aikin, who was employed on a survey of Poona city. At the end of 1824 the party had completed Belgaum, Dhārwār[13], Poona, Ahmadnagar, and Sholāpur[14], mostly on scale

[1] latitude 21° to 15°. [2] Samuel Hemming, also Bo. Engrs., joined during 1818. [3] Sir Lionel Smith (1778–1842); Lieut-Gen.; Bart. 1837. *DNB. DIB.* [4] Poona Residency burnt by Marāthas, 5–11–17. [5] from Elphinstone, 6–12–18: MMC. 23–12–18. [6] Boles, Perry, Montgomerie, later replaced by Steel and Cunningham. [7] between Tungabhadra & Kistna [115]. [8] from Mountford, DDn. 148 (100), 19–5–19. [9] Bo MC. 12–7–20. [10] ib. 4–10–20. [11] ib. (camp), vol. 59 (206), 7–6–22. [12] Grafton, N. Campbell, Steel, Cunningham, Gordon, Boyd, Le Messurier, J. Campbell, and Swanson. [13] Map of Dhārwār, 1825, MRIO. 127 (2). [14] Report for quarter ending 31–7–24; Bo MC. 137 (200).

two miles to an inch. In 1825 special authority was obtained for the employment of draughtsmen for fair mapping, thus freeing officers for field survey [284][1].

By 1825 Jopp's staff was reduced to Grafton, Boyd, Benbow, Shortrede[2], and Aikin. The maps, including that of Kolhāpur were almost finished[3]. In February 1826 Grafton took over charge from Jopp who succeeded as Deputy Surveyor General [323] and two civilian assistants, Price and Sanger, joined from 1st May. The survey was closed down on 31st May 1830, after completion of the whole country south of Khāndesh, and Jopp reports two years later ;

> The Duckun, comprising the large collectorates of Dharwar, Poona, and Ahmednugger, the territories of their Highnesses the Rajas of Satara and Kolapoor, and the possessions of the great Southern Mahrata Jahageerdars, has been surveyed in detail [pl. 24].
>
> Six sheets...have been forwarded to the Hon'ble the Court of Directors, and the remainder of the survey is ready to be embodied so soon as the triangulation now carrying on under Lieut. Shortreed shall enable me finally to connect it together.
>
> The boundaries of this large province are—The Ceded Districts and the Goa territories on the south—the Nizam's dominions on the east—the range of Ghauts on the west—and Khandeish on the north. No part of this extensive tract will require to be again surveyed[4].

Before handing over charge as Surveyor General Hodgson reported that,

> Colonel Lambton's triangles not having been extended to the northern part of the Bombay coast, the surveyors want some of the advantages which they give on the Madras side. Several minor triangulations have been made by the Bombay officers, and a triangulation on a larger scale has been recommended, and with a better instrument.
>
> The Bombay surveyors are a respectable body of officers[5].

The valuable revenue survey of Sātāra carried out by Adams and Challen is described in a later chapter [171].

SOUTH KONKAN, 1819–30

The term Konkan applies to the strip of country lying below the Ghāts along the west coast ; North Konkan stretches southward from the Damān River to the Bānkot, and South Konkan from the Bānkot River to Goa [pl. 24].

In October 1819, Thomas Jervis, of the Bombay Engineers, was appointed executive engineer in the South Konkan and twelve months later deputed to prepare a statistical survey for the revenue department in addition to his engineer duties. In January 1823 he was relieved from the latter and placed under Sutherland for geographical survey to be carried on separately from the statistical survey[6]. He measured base-lines in co-operation with Robinson of the Bombay Marine, and carried out triangulation for his detail survey[7]. Sutherland reports in January 1824 ;

> Lieutenant Jervis' exertions have been equally unremitting and highly satisfactory...—trigonometrical survey between Dewghur and Borcia—sketch map of the country between Anjenwell and Bankot—...plans of the Forts of Rutnagherry and Viziadroog[8].

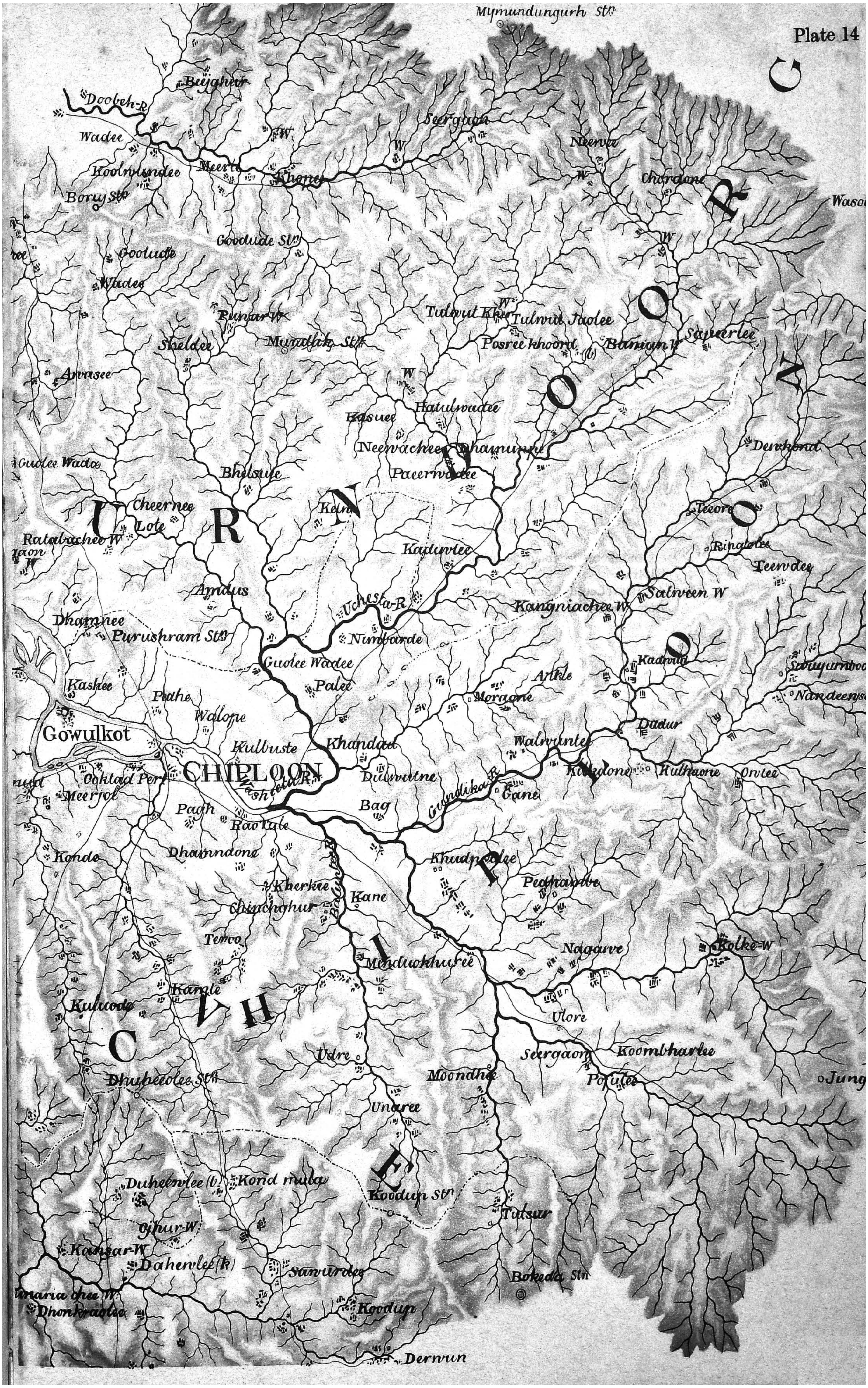
Much of his energy was devoted to reports and large scale surveys of no particular topographical value, though in 1826 he produced a useful map of the Konkan from Goa to Damān[9]. The survey was closed down with the Deccan survey in 1830 [*sup*], and Jervis had to leave his work incomplete. He worked up his statistics into compendious reports, and shewed

> in separate maps the geographical distribution of the indigenous plants, the statistics of revenue, commerce, education, industry, crime, slavery, religion, language, caste, and general distribution of the population[10].

His triangulation[11] and topographical survey[12] were not of a high quality, which was unfortunate as there was no other survey of the area and, writes Jopp,

[1] Bo MC. 17–3–25. [2] name spelt Shortreed & Shortrede indiscriminately, Shortrede being form associated with his logarithm tables. [3] Kolhapur, by R. Foster, MRIO. 127 (9) ; list of original plans, DDn. 278 ; progress chart, MRIO. 122 (22). [4] DDn. 235 (20), 3–5–32. [5] DDn. 231 (236), 24–1–29. [6] Bo RC. 98 (102), 31–1–23. [7] Map of coast, MRIO. 118 (2), M 564. [8] Maps & triangles, ib. 126 (1–16) ; 196–7 ; 127 (6–8) ; M 78, 96 ; Bo MC. 137 (101), 8–1–24. [9] MRIO. 123 (6, 7) ; M 564 [10] *Bo Geo Soc P.* (175). [11] Chart, 1827, *Ben Regr.* 594 (66). [12] One-inch maps, DDn. 278 (109, 324, 337, 401–2).

Plate 14



Mymundungurh Stn
Doobeh R
Beyghur
Seergaon
Wadee
Koolwundee
Meerte
Khoner
Neervee
Chardone
Wasoo
Bory Stn
Goodude Stn
Gooludie
Wadee
Punar W
Sheldee
Muralik Stn
Tulwut Khur
Tulwut Jaolee
Posree khoord
Baniyun W
Saperlee
Awasee
Kasuee
Hatulwadee
Neewachee
Dhamunee
Paeerwadee
Bhelsuee
Denkond
Gudee Wadee
Cheernee
Lote
Kelnee
Teeore
Ratabachee W
Kadwlee
Ringnee
Teewdee
Amdus
Uchesta R
Salween W
Kangniachee W
Dhamnee
Purushram Stn
Nimbarde
Gudee Wadee
Kadwul
Arkle
Swayumboo
Kashee
Palee
Moraone
Nandeens
Pethe
Walope
Dadur
Gowulkot
Kulbuste
Khandaut
Walwuntee
CHIPLOON
Oohlad Pet
Washishtee R
Dalwutne
Gundlika R
Kulkdone
Kulhaone
Orvlee
Meerjol
Gane
Bag
Pagh
Raotule
Konde
Dhamndone
Khudpolee
Kherkee
Pethambe
Kane
Chinchghur
Terve
Nagarve
Kolke W
Menduokhuree
Kamte
Kulode
Ulore
Udre
Seergaon
Koombharlee
Moondhee
Dhuhewlee Stn
Potulee
Junge
Unaree
Duheewlee (k)
Kond mula
Koodup Stn
Tulsur
Ojhur W
Kahsar W
Dahewlee (k)
Sawurdee
Bokeda Stn
Dhonkraolee
Koodup
Dernun
U R N D O O R G
C H I P L O O N
O O N
C H I P E

Part of RATNĀGIRI, SOUTH KONKAN

CHIPLOON is about 30 miles south of Mahābaleshwar and s.w. of Sātāra.

Reproduced from map drawn on half-scale by J. Hanson 1833, from one-inch survey by Wm. Dowell, 1828 to 1830 [127].

Reg. No. 4848 HD'50-800'51. Printed at the Survey of India Offices (H. L. O.)

after a most careful and tedious examination of the maps with the lists of village, ... so many appear wanting, and there are such discrepancies between the original and the compiled maps, and most of the former [are] in so unfinished a state, that I cannot report the plans of this province as fit...for the Great Map of India[1] until such parts as require it be again surveyed[2].

Everest, and again Waugh made further exhaustive examinations and refused to accept the survey for geographical purposes, in spite of Jervis's own claims[3]. The following unofficial note was published in 1856 ;

In this...report of his land survey in the Concan, an incorrect latitude is assigned to many places ; and...not very lately an error was discovered in the triangulation which renders it, as far as correct distances are concerned, nearly useless. He stated before the meeting of the British Association at Newcastle-on-Tyne [26–8–38], that these maps had been retained in India. Probably it was even then known, or suspected, that some error existed in them ; but he quoted them to the meeting as models of what was required throughout our Indian Empire[4].

In March 1824 William Dowell was nominated for charge of a similar survey of North Konkan[5], being first attached to Jervis

for the purpose of gaining an insight into the duty, ... that all surveys carrying on under the Bombay Presidency may be conducted on one uniform principle, to prevent the necessity of any other surveys being taken hereafter[6].

From 1826 Dowell's work was confined to Ratnāgiri District, of which there is an elaborate map in several sheets on the one-inch scale, completed between 1828 and 1832. It is remarkable for the hill drawing—bold neutral tint shading,—most effective[7] [pl. 14].

There are also maps of the country between Mālvan and Vengurla in south Ratnāgiri by Augustus Hervey, apparently surveyed before 1819[8].

KĀTHIĀWĀR, 1822–5

At the end of 1821 the political agent in Kāthiāwār asked for a survey, as his only available map was one compiled from the military route surveys of 1808–9 [II, 169]. Stephen Slight of the Engineers, who had been on the Deccan survey under Sutherland [125], commenced work in February 1822, and continued for three years. He reports in June 1823 on the work of his second field season ;

After recovering from a severe illness I commenced this season at Gogah, from whence I proceeded along the sea-coast to Due[9], thence to Mahadupoor, making occasional marches to the northward. I then struck into the Geer hills[10], which I crossed at Delkhannia and arrived at Ghauntwar, a distance of above thirty miles without a single village intervening, meeting with the greatest difficulties. ...

I understand there is but one route over the hills, notwithstanding the great extent of them. To survey the whole correctly I shall be obliged to cross them in ten or twelve different directions. ... After passing over the hills I continued the survey in a parallel direction to my former route, and on 30th May arrived at Rajkot[11]. I shall instantly commence on the plan of the cantonments. ...

As the season for out-of-door work is now past, it is my intention...to proceed to Baroda, there to remain until the monsoon is over, in order to make a fair plan of this season's survey. Immediately on the opening of the fair season I shall proceed...to Gogah, at which point the survey will recommence. ... My principal wish to go to Baroda proceeds from the whole of my drawing materials having been left there[12].

He reports on July 1824 ;

A part near Umrailly and a small portion to the southward of the Geer hills remains unsurveyed. ... It would have been all completed had I not received directions from the Deputy Surveyor General to make a trigonometrical survey of the peninsula ; in doing which I was obliged to retrace some of my former routes to correct any little error that may have occurred

[1] The ¼-inch atlas [284]. [2] DDn. 235 (20), 3–5–32. [3] Waugh to Thuillier, 21–2–50 ; DDn. 557 (6). [4] *Bo Qy Rev.* III, 1856. [5] Survey of country SE. of Bassein, MRIO. 127 (10). [6] Bo RC. 537 (73), 12–3–24. [7] MRIO. 126 (1–15) with ½-inch reductions drawn 1832–3 ; DDn. 278 (1, 20, 176–80). [8] MRIO. 124 (19–22) ; DDn. 278 (258). [9] Diu, 41 L/14 . [10] Complains of excessive attraction of magnetic needle by local ore, Junāghur, 2–5–22. [11] 41 J/15. [12] Rājkot, 5–6–23 ; Bo RC. 98/1823 (247).

whilst surveying the different roads. I shall be...making two or three diagonal routes through my first season's work...in order to find out any mistake that may have happened from my not having at that time trigonometrical points to connect with.

The duties I am now engaged upon are as follows ;—making a fair copy of the survey—reducing the same to 48 miles to one inch—making a copy of the trigonometrical survey—calculating all the triangles—making up journals of the whole of the country surveyed—writing a memoir of the same—and, if possible, to reduce the whole of the survey to 4 miles to one inch.

I may with safety say that what remains unfinished...will be completed in three months. I might do it sooner but, wishing to make two or three other marches through the Geer hills, I have added one month to the time[1].

He submitted his fair map of the season's work in October, reporting that

the number of villages I have fixed last season amounts to upwards of...one thousand. The hills are nearly completed, and from the trigonometrical points that I have fixed the whole of what is at present completed...will be found most correct.

It is my intention to leave camp immediately, and when I have completed those parts that now remain I shall proceed towards Poorbunder to correct my first season's work by my trigonometrical points. Having accomplished this...I shall measure another base-line somewhere between this place and Nowanugger[2].

The survey was completed and formerly closed in September 1825[3].

NORTH KONKAN & GUJARĀT

The important revenue surveys of Bombay and Salsette islands by Dickinson and Tate, and of Gujarāt by Williams and Cruikshank, are described in a later chapter [167–71]. In October 1817, Dickinson was taken off his revenue survey to make a military survey of Bassein and Kalyān. His party was seriously troubled by fever and the monsoon rains. He writes from Bassein where he had retreated for medical assistance ;

I have taken accurate plans of 16 forts—surveyed the whole extent of coast, including the mouth of all the rivers and creeks of our new acquired territory—and, from having continued my operations through an equal extent of the interior, ... it will require a considerable time to arrange what I have already done...for assisting...His Excellency the Commander-in-Chief as to ...the security and defence of the Bassein purgunnah.

Most of the men he had brought from his revenue survey establishment were sick, and he asked for a fresh batch for the Kalyān districts ;

Owing to the severity of the weather in the first instance, and the natural obstacles which I had afterwards to encounter, I was obliged to perform the greater part of my last duties, not only without a tent, but without any shelter than what the jungle afforded.

Little is known of topographical surveys further north. In describing possible material for the atlas Jopp notes that those of

North Conkan, tho' greatly improved by the surveys of Mr. Horne[4], ... [are] not to be classed as *fit* for the *Engineer*—Surveys of Gujarat are good, and if connected to southern surveys by triangulation could then be incorporated—Rajpeepla and east frontiers of Guzerat [II, pl. 15], maps are extremely deficient [pl. 24].

Peninsula of Goozerat improved by surveys of Lieut. Slight—a map of Cutch by surveys of Slight, Lieuts. Peat and Grant of the Engineers[5], and of Lieut. Burnes of 21st Regt., but not fit to be engraved.

Horne, who came from Madras, was employed under the Collector during 1820–1, and his survey, made by perambulator and compass traverse, is elsewhere described by Jopp as "an original & valuable survey"[6]. It covers the country from Kalyān to Bassein, and along the coast north to Damān[7]. Jopp writes again later ;

[1] Rājkot, 17–7–24 ; Bo MC. 137/1824 (146–9). [2] Rājkot, 14–10–24 ; ib. (212). [3] Map, MRIO. 123 (19) ; Bo GO. 17–9–25. [4] Francis Horne, possibly father of E. Horne, dmn. in SGO. Bombay from 1832. [5] Alexander Cumine Peat, Bo. Engrs. Ens. 18–20...Maj. 1839 ; CB.; d. Karāchi 1848 ; John Schank Grant, Bo. Engrs., Ens. 1822...Capt. 1832 ; d. Mhow 1840. [6] *IO. Cat.* (439) ; DDn. 278 (3) ; MRIO. Misc. 15–O–33. [7] Index to Surveys, MRIO. 125 (10).

The maps of the Northern Konkun are not...in a state to be used for the Great Map; this district will therefore require to be surveyed; a portion of this province bordering the range of Ghauts belongs to independent Bheel chieftains, whose country is but little known.

With the exception of those parts over which the revenue surveys under Colonel Williams, and subsequently under Captain Cruikshank, extend, the whole peninsula of Goojerat with the district of Rajpeepla, the country in the vicinity of the military station of Dewa, and that to the east and north-east from Baroda, will all require to be surveyed, as our knowlege of those parts is very scanty, and...also very incorrect.

The province of Khandesh also requires...to be at least partially surveyed, and to be reconstructed anew [123–4]. The independent territory of Kutch should also be surveyed, if the sanction of its government can be obtained[1].

A sketch was made of Rājpipla in 1822 by James Down with little in the way of instruments; mainly compiled from Reynolds' map and information collected locally[2]. In Gujarāt useful route surveys had been made by Cruikshank and Remon.

TRIGONOMETRICAL SURVEYS, 1819–30

As Lambton's triangulation had not covered any part of the Bombay territories, except for the series which Everest had abandoned short of Sholāpur [234–6, pl. 18], the Bombay surveyors had to provide their own triangles, and in most cases measure their own base-lines. Both Jopp and Jervis connected with Garling's work in Goa and the Nizām's dominions [125]. Whilst on the survey of Raichūr early in 1819 [115–7], Garling had made special arrangements for such connection "having understood that a requisition was about to be made for such documents by Major Sutherland, Superintendent of the Poonah survey"[3]. Shortrede describes how Jopp met Garling, and

obtained from him the approximate lengths of some of his lines, and upon these Captain Jopp and also Captain Grafton continued a series of triangles from the eastern to the northern extremity of the Ahmednaggur collectorate[4]. Captain Garling having expressed himself quite willing to give a complete copy of all his work if it were asked for in the regular way, Captain Jopp...urged strongly the advantages of possessing such valuable materials, but his superior in office rejected the advice, and declined to make the application [125].

When Captain Jopp became Surveyor of the Deccan [1822], he...obtained a copy of Captain Garling's materials, and upon these bases he carried a triangulation through the southern Mahratta country and the Sattara territory, and through some parts of our own provinces eastward.

Captain Jopp's observations to all principal points were duly entered in an angle book, and ...the calculations were afterwards made. The secondary points, especially in hilly country where the number of conspicuous objects was great, ... were sketched panoramically through the telescope, every remarkable point having its direction marked beside it. These were observed again from other stations, and the points so intersected were laid down as good secondary points for the detail surveyors to work upon[5].

Waugh records that "Captain Jopp, in his report dated 24th July 1827, speaks unfavourably of his own triangulation, which he did not consider final"[6], but Jervis had no such diffidence, and has left long accounts of his work. He had attended a course with the Ordnance Survey in England before coming to India, and makes constant reference to the writings of Laplace, Roy, and Lambton. He starts his report[7] with a sententious discussion of the superiority of trigonometrical survey over a framework of measured routes [209–10], and continues;

I have been particularly fortunate, altho' very ill & tardily supplied with everything in the way of instruments, to have the generous and unceasing assistance of scientific friends who have furnished me, amongst other things, with a transit circle, a Mayer's repeating reflecting circle of elegant workmanship and finely graduated scales. ...

[1] DDn. 235 (20), 3–5–32. [2] DDn. 278 (31). [3] Hence Mackenzie's warning against "anticipating orders" [118]; Mountford to SG., 19–5–19, DDn. 148 (100). [4] Chart of Grafton's triangles, DDn. 278. [5] DDn. 325 (58), 16–9–41. [6] Waugh to Rivers, 18–9–44; DDn. 325 (329–33). [7] MRIO. M 195.

I am obliged to my friends, Capt. J. Robinson, of the Hon. Company's Marine, and to the late Colonel Cooper of the Engineers [II, 392], for their very kind assistance, for supplying me with...instruments ; ... and to the former...especially...for instructions on difficult matters. ...

The trigonometrical operations of the late Captain Garling having been brought to the northern limits of the Portuguese territories at Goa, and Captain Jopp being engaged with the triangulation in the upland country east of the Concan, I sought for a base-line situated centrically between the plains of Atgaon and Kallian[1], and Camoerlim near Goa, in order that the whole extent of the coast from St. Annes to Duman[2] might be divided into three portions, each of about 2 degrees.

He measured his first base during February and March 1824 at a site selected by Dowell near Nizāmpur ; he made three measures and took levels. From the base on the Atgaon plain he proposed a chain of triangles northwards to Gujarāt which did not mature. The whole was connected with Jopp's triangles to the east. As already noted, Jervis did not devote his entire attention to his triangulation, which was not of a high order [126–7].

In July 1827, Jopp reported that he had just received

a new standard steel chain from England, and...had commissioned a very superior theodolite from Troughton, and...intended that these instruments should be used in the Deccan survey[3].

As the Deccan survey was about to be closed, he suggested that these instruments might "be advantageously employed on a trigonometrical survey of the whole of the Bombay Presidency", a proposal welcomed by Hodgson. Under sanction from the Supreme Government,

on 15th March 1828, Lieutenant Shortrede, of the 14th Bo. N.I., an officer of considerable talent and mathematical knowledge who had already been employed in the Dekan Survey, was appointed to superintend. ... He was directed to measure a base...and to carry on a triangulation from thence over the whole country, connecting it with that of Captain Garling on the south, and with the Great Meridional Arc on the east, or rather with the series which had been commenced by Captain Everest [129, 234–6].

Captain Hodgson also intimated that if the work were sufficiently well executed, it might be adopted into the G. T. Survey, but he left that point to be decided by its own merits.

Mr. Shortrede, having selected a site for his base on the Karleh plain, about 40 miles east of Bombay[4], and having occupied himself during the rains of 1828 in preparing the requisite apparatus, etc., proceeded to the spot in the month of November and, with the assistance of the Deputy Surveyor General [Jopp], of Captain Grafton, the Surveyor in the Dekan, and their establishment[5], commenced the measurement on the 12th December 1828, and finished it on 16th January 1829.

The base was 4·065 miles in length, and had the defect of a break in the measurement caused by the river Indrawni[6]...whose abrupt banks and uneven rocky bed prevented the measurement from being carried directly across. The length of this portion, nearly 1000 feet, was therefore determined by triangulation, but...the error arising from this source must be considered within 1·0 inch.

The remainder of this season and the next three years were occupied in extending a net of triangles from this base over the whole country, from latitude 18° to 21°, and from longitude 73° to 76°[7]. ...

The triangulation was carried on to the westward so as to fix the position of Bombay Lighthouse, and on the eastward the work has been connected with Captain Garling's stations Poorundhur and Bholeshwar. In the Southern Konkan Captain Jervis' stations...have been visited, and connected with...stations in the Dekhan survey[8].

In 1834 Everest rejected the whole of Shortrede's work as unworthy of confidence; extracts from his severe comments are here recorded ;

In July 1827, while I was in Europe, a proposal originated with Captain Jopp...to commence triangulation. ... If the masterly view taken of this subject...by Lt. Col. Hodgson...had been rigorously attended to, much time, confusion, and expense, would have been avoided[9]. ...

Instead of this well-advised plan being abided by, ... Lieut. Shortrede, ... a gentleman of considerable scientific acquirements, but of no practical knowledge in geodetical operations,

[1] Atgaon, 48 E/9 ; Kalyan, 47 E/4. [2] Sta. Anna, 48 E/15 ; Damān, 46 E/15. [3] DDn. 220 (273), 11–9–27. [4] Kārli, 47 F/5, 5 m. E. of Khandāla Ghāt, 78 road miles from Bombay. [5] including Boyd, Webbe, and Sundt. [6] Indrāyani, R. [7] DDn. 518 (202), Sept. 1842 ; *GTS.* XII. iii. B. [8] DDn. 323, 3–6–29 ; index shewing area covered, MRIO. 125 (8, 10) [pl. 24]. [9] Hodgson's letter of 11–9–27 suggested start from Everest's series ; DDn. 220 (273–6).

was nominated to the charge of conducting a General Trigonometrical Survey, as it was denominated, emanating from an independent base of its own, and measured by a chain altogether independent of the units used by Lt. Col. Lambton and myself.

A base was accordingly measured in the Karleh plain...with a very excellent chain by Cary, whose length...was subsequently in 1832 determined at my office in Calcutta. ... It has a slight defect in one part, which was caused by its...being intersected by the Indrawni. ... As this part of the work was skilfully executed, the blemish certainly seems...more apparent than real. ...

The measurement of the Karleh plain base is the sole portion of the work originally executed by Capt. Shortrede which is entitled to commendation. The stations selected by that gentleman were certainly suitable, ... but the performance, whether as regards the observations of angles, or celestial azimuths, or the signals used, or the precautions taken to ensure accuracy, was so very slovenly...and so replete with discrepancies, that it has been entirely set aside, and treated as mere...preparatory work. It could not be otherwise. The letter of my predecessor in office, Col. Hodgson, ... though to all intents directly opposed to the sort of general, or fly-away, triangulation advocated by Captain Jopp and Shortrede, was received by those gentlemen as quite confirmatory of their wild independent scheme. ...

Any person who in the present day endeavours to strike out a line of his own in geodesy will meet with failure. ... He must submit to be instructed by those who have more experience than himself[1].

CUTCH & SIND, 1825–30

Little was known of either Cutch or Sind beyond surveys of the coasts by officers of the Bombay Marine—sketches and reports by MacMurdo 1809–11 [II, 169–70]—sketches of the Indus below Hyderābād by Maxfield and Christie 1809 [II, 168–9]—and reports from Reynolds' Indian explorers [I, 218–9, 246]. All these were embodied in a "Map of Cutch and the adjacent portions of Gujrat and Sind, principally from the works of the late Lt. General Reynolds", completed by Williams in August 1820[2].

Substantial additions made by Alexander Burnes, who was posted as D.A.Q.M.G. in 1825, and attached to the staff of the Resident, Henry Pottinger [II, 437–8]. Encouraged by Pottinger, he produced "a new map of Cutch, to the eastern mouth of the Indus...compiled from actual measurement and personal observations during the years 1825–8"[3], which was lithographed in 1829.

Another of his maps is "A Sketch of the Runn and Countries adjacent, to illustrate a Memoir on its formation, and the alterations of the Eastern Branch of the Indus". This was lithographed at Edinburgh in 1831, and appears in the history of Cutch[4] written by his brother, Dr. James Burnes, surgeon to the Resident. The frontispiece is another sketch, shewing the route from Bhūj to Hyderābād which James followed at the end of 1827 to meet a call for medical assistance.

I have carefully examined all the maps of Sinde in common circulation, but have found none so generally correct as the one from which the prefixed...has been partly compiled. It was sent to me while on my route to Hyderabad by my brother, who had copied it from "A Sketch of the Indus from Shikarpoor to the Sea" by Samuel Richards[5], 1810, in the Q.M.G.'s office Bombay, a delineation which must have been constructed, I think, from native information.

I have made a few additions to it, as well as some alterations which are, I believe, very nearly correct. Although, as I had not even a compass with me, and could judge of distances only from doubtful information and the time occupied in passing from one station to another, it cannot be considered entitled to the same credit as a map constructed on mathematical principles, ... it is a truer delineation of Sinde and its grand feature, the Indus, than any which has hitherto been published in Europe.

The delineation of Cutch, ... etc., will be found strictly correct, being, in fact, a reduced copy of a map compiled from actual measurement and observation by my brother, Lieutenant Alexander Burnes A.Q.M.G. of the Army[6].

[1] TS. VIII (1–4). [2] MRIO. 122 (1), 4 m. to inch ; huge paste-up, clear and clean. [3] Map, 4 m. to inch ; *IO Cat.* ; MRIO. 119 (12) ; 122 (17) ; Memoir in IO Lib. [4] faces p. 145, *Court of Sinde.* [5] Samuel John Richards (1794–1819) ; Bo. Engrs. Ens. 1810 ; Lieut. 1813 ; d. London, 15–1–19 ; obviously compiled this sketch in C.E.'s office during his first year. [6] *Court of Sinde* (3–4) ; cf. *JRGS*. I (222–31).

In 1829 Alexander obtained permission from Malcolm, now Governor of Bombay,

to traverse the deserts between India and the Indus, and...endeavour to descend that river to the sea. ... Sir John Malcolm despatched me at once...and was pleased to remove me to the political branch of the service. ...

In the year 1830 I entered the desert, accompanied by Lieutenant James Holland of the Q.M.G.'s department. ... After reaching Jaysulmeer we were overtaken by an express from the Supreme Government of India desiring us to return[1].

A sketch of this trip entitled "Geographical Index to the Map of Southern Rajputana, constructed in 1829–30" is signed by Burnes as "Assistant Resident in Cutch, Booj Residency, January 1831", with a note, "my own field-book, and the detours from my route by Lieut. Holland, will be found attached to these papers"[2] [pl. 24].

Burnes' account of this map is well worth quoting as indicating the style in which he worked[3]. This was the first of a series of remarkable journeys which he made beyond the north-west frontiers, all resulting in maps full of new information.

The extreme point of the map eastward is the camp of Nusseerabad in Ajmer, the longitude of which is 74° 49′ 12″, eastward of Greenwich, as deduced from a mean of five observations of the first satellite of Jupiter, for which I am indebted to Brigadier Wilson of the Bengal Army, and Commanding the Field Force in Rajputana[4].

The western point of the map is the sea port of Mundivee in Cutch, which is in longitude 69° 34′ 0″, east of Greenwich, as fixed by several observations, in particular of Captain Maxfield, late of the Bombay Marine [II, 429].

The latitudes...have been determined by the sextant with false horizon. Observations were taken daily by two different sextants. ... The extreme point north is Jaysulmeer, which is in latitude 26° 56′ 0″ north, or about half a degree lower than in the most approved maps of India. That of Mandivee is 22° 51′ 0″ north.

The survey was first laid down at the scale of two miles to an inch, that attention might be given to the topography of the country. This was, however, found to be much too extended. ... The present map has, therefore, been reduced to that of eight miles to an inch, and the minute account of every stage in the journal will amply supply the loss in topographical knowledge.

It was judged prudent to avoid as much as possible carrying any instruments or apparatus which might excite the suspicion of the people. Perambulators and theodolites were therefore dispensed with, and the valuable compass by Schmallhalder substituted in lieu of the latter.

The rate of march was...previously determined by perambulator and other means to be a few yards less than four miles an hour, and which was consequently adopted. There were many opportunities, ... by cross bearings from hills at a considerable distance, to judge of the justness of this calculation. ...

The survey...was much facilitated by the hills, ... some...visible at a distance of forty-five miles. ... One most important point westward was the peak over Balmen[5] in the desert, from which a hill, called Goeenu, on the river Loonee, about forty miles eastward, was visible. From Goeenu there was a succession of five peaks to Chung hill in Ajmeer, and as the detail survey between these points had always a check from each, great correctness was thereby ensured, and in addition to this there was a minute road survey made between each stage. ...

I can not express myself better than in the words of my journal of the 20th March 1830. "The period is now drawing to a close when the journal must end by my return to Cutch, ... I march exactly at daylight, and survey till about 10 o'clock, which, in the mildness of the cold season can be done without inconvenience. On the road I always enter into conversation with the village guides, whose extreme simplicity fits them well to convey information about themselves, their country, and their customs.

"By 2 P.M. the survey of the morning figures on the map, and the latitude is determined to correct it, when a party of two, three, or four, villagers are invited into my tent to talk... till within half-an-hour of sunset. I ask the distances of all the villages around within ten miles, the road to each, and the cross distances of one to another, which I sketch roughly on paper without any regard to scale, but which greatly facilitates the survey. ...

[1] from Burnes, London, 7–6–34; *Bokhara*, III (x). [2] BM Addl MS. 14382 (46): reductions, MRIO. 84 (33–4); Bokhara, I (193). [3] DDn. 262 (102–16) 4–11–31; cf. *JRGS*. IV, 1834 (88–129), with sketch. [4] Edward Pitches Wilson (1773–1833) Ben. Inf.; Hodson, IV (491–2). [5] Barmer, 40 O/5.

"In the evening I take the angles to all hills and towns in sight of my encampment, and also a series of bearings to such as are beyond view, by guess, on the direction being pointed out by a villager. ...

"Lieutenant Holland, who accompanied me, followed a similar plan, and took...when the state of the country would admit of it, a separate route from myself, and by our joining every eight or ten days, to *start anew and, moving on similar points, and in parallel lines at a distance* of from 20 to 25 miles, we have been enabled to entirely fill up the intermediate spaces between our routes through the southern portion of Joudpoor." ...

The object which I had in view...was to trace the Loonee from its embouchure in the Runn of Cutch to its source in mountains of Ajmeer. This has been fully accomplished. ...

I have also included some of my former surveys, the Bunass river and Aboo, ... also the route across to Ballyaree in Scinde, ... Cutch is from my own map of that country.

Besides coastal charts by Brucks, Haines[1], Robinson, and many others [17, 70], the Survey of India holds a "trigonometrical survey of Bombay Harbour" surveyed 1829 by Lieutenant Robert Cogan, of H.C.'s marine, assisted by George Peters, midshipman, and published by Horsburgh in May 1833[2]. Many of these charts are signed by Lieutenant M. Houghton, who was for some years draughtsman to the Indian Navy at the Colaba Observatory[3] [191–2].

In his account of the mission to Persia of 1809 [II, 176], Morier notes that "our ignorance of the gulph" was due to

the prudential reserve which has influenced our Indian Governments in their transactions with the states of Persia and Arabia. To avoid suspicion and complaint they have never professedly made surveys of the shores, though much might have been done indirectly. ... Few except merchant vessels visited the gulph, and as the charts which they already possessed... served their purpose sufficiently...there was seldom any particular demand for more correct surveys.

The geographer and philosopher indeed require something more, and therefore it is still matter of regret that we are comparatively ill-informed in countries where we have had easy opportunities of acquiring knowledge[4].

[1] Geo. Barnes Brucks, Bo. Mar.' Mdpn. 1811 ; Comdg. 1829 ; Capt. 1833 ; comdd. Survg. ships *Psyche, Discovery, Benares*—Stafford Bettisworth Haines, Bo Mar., Mdpn. 1818, Comdr. 1835 ; PA. Aden, 1842. [2] *IO. Cat.* (428); Markham (11–3, 23). [3] MRIO. 101 (22) ; 105 (7, 27–8) ; DDn. 278 (4–6). [4] Morier (9).

CHAPTER X

REVENUE SURVEYS, LOWER BENGAL

General Policy — Miscellaneous Surveys — Noākhāli & Chittagong, 1821–9 — Sundarbans — Sylhet & Assam, 1822–30 — Methods of Survey.

THE permanent settlement of land revenue in Bengal had been determined in 1793 on the basis of the latest district settlements, however derived, and, though the amount of revenue to be collected from each estate was thus permanently fixed, there was no reliable record of the extent of these estates [I, 140–1 ; II, 177]. Land that was brought into cultivation later than 1793 was not included in the permanent settlement, and for a long time escaped liability for assessment[1]. A regular feature of the advertisement columns of the *Calcutta Gazette* of this period was a list of sales of lands by public auction for the recovery of arrears of revenue[2], a situation hardly anticipated when permanent settlement was first introduced.

There were long discussions on the adoption of permanent settlement elsewhere, the Directors opposing hasty action in new territories [II, 178]. They wished their government to acquire several years experience of conditions in each district before making any long-term arrangement, and strongly urged the advantages of systematic land survey [7, 150].

The areas of immediate concern were the Ceded and Conquered Provinces beyond Bihār [II, 110 ; III, 149–63], the newly conquered lands of Cuttack and the rapidly extending cultivation of the Sundarbans [II, 177–8 ; 139–44]. The Bengal Council admitted the advantages of reliable surveys, but pointed out the untrustworthiness of indigenous systems of land measurement, and urged that any surveys undertaken for revenue purposes should be directed by European surveyors under the professional control of the Surveyor General ;

> Although the Government of this Presidency has more than once stated, in strong terms, the objection...to the actual measurement of lands by the slow and tedious process of the natives [II, 179], it did not...intend to express any opinion adverse to surveys undertaken by professional persons, and executed in a scientific manner. ... The most substantial advantages may be derived from surveys of the *latter* description.
>
> They are obviously calculated to ascertain and fix the boundaries of estates, ... and various other points involved in the settlement of lands. ... Such surveys prevent those serious affrays which, although materially repressed by the vigour of the police during the last three or four years, still exist to a certain degree, ... as often as disputes may arise regarding the boundaries. ... They are likewise calculated to facilitate the partition of estates. ...
>
> We have taken the necessary measures for organizing an establishment for the measurement of estates with the aid of the Surveyor General of India. ... The primary object...is the acquisition of...information...required in the Ceded and Conquered Provinces with reference to the impending settlements. ... The establishment...may be...highly beneficial in enabling Government to draw an increasing revenue from the lands reduced to cultivation in the Sunderbunds, in the frontier district of Chittagong, and in other places[3].

The settlement of the Sundarbans was taken up in 1814, with the aid of Morrieson's survey [II, 14–5, 177], and Alexander Gerard was appointed surveyor to the Revenue Commissioners of the Ceded and Conquered Provinces for settlement of Sahāranpur [II, 180]. The raising of an establishment of revenue surveyors was postponed till Mackenzie's arrival from Madras ;

[1] The ultimate ownership of all land rested with the ruler of the country [I, 133]. [2] *CG.* 1–2–16 ; etc.
[3] B to CD., Rev. 7–10–15 (8) ; *BRS.* (294).

We shall, however, lose no time on his arrival at this Presidency. ... In the meantime we trust that measures which have been taken will, at a very early period, afford to the revenue officers...the assistance of an agency infinitely superior to that to which they had hitherto...for the measurement of estates, and the determination of their limits[1].

The Directors warmly approved;

We cannot but regard this concurrence of sentiment as a fortunate and auspicious circumstance. ... We sanction your appointment of Ensign A. Gerard...to be Surveyor to the Board of Commissioners. ... We direct that a specimen of Mr. Gerard's survey be transmitted for our inspection, that we may have an opportunity of comparing it with a specimen of a revenue survey of the pergunnah of Broach...lately submitted to us by the Government of Bombay. ...

The utility of measures of this sort will...depend altogether on their being skilfully conducted; and we entirely agree with you that persons should be found possessing a knowledge of the general principles of geometry and mensuration, to act under the guidance of the principal surveyor.

We would also suggest to you the expediency of your applying to the Governments of Fort St. George and Bombay for specimens of the revenue surveys which have been executed under those presidencies[2].

The Council thought the Bombay system far too elaborate and expensive[3] [II, 188–9; III, 6, 171, 173–4] and sought for simpler procedure;

A minute village survey, exhibiting...the limits and extent of each field, and the number of trees growing therein, with...the name of the occupant of each field and the rent paid by him, was likewise tried, but abandoned as too laborious and expensive; and such a field survey is...now generally admitted to be fallacious as a means of adjusting any permanent assessment.

The general survey which formed a complete and palpable record of the extent and limits of each village, and of the distribution of its lands, ... would...embrace almost everything that could be desired, either for revenue or judicial purposes, and a more detailed course...in regard to this Presidency would appear to be entirely out of the question. It seems probable, indeed, that we must rest satisfied with a more general survey. ...

It is...the more necessary to observe a strict economy, to confine the survey to objects of clear utility, and especially to employ for the details...a cheaper agency than that of European officers. ...

If the survey were confined to the fixing of the limits of estates (to be marked off by the Revenue Officers with a double line in the case of disputed boundaries...), the labour would...be comparatively lightened, and a pergunnah or district survey, marking merely the position of villages and fixing the extents of the larger divisions, could probably be completed at a moderate charge, and certainly within the times necessary for the revenue officers to collect...the information...required...[for] a permanent settlement[4].

Mackenzie took a long time to consider the problems involved, being much hampered by ill-health. He writes to the Revenue Secretary a few weeks before his death:

I have now got the Bombay revenue surveys from your office, and I shall be prepared in time to exhibit a comparative view of all that has been attempted in this way in different parts of India. I am indeed astonished that a detail of the lands of every individual village in a pergunnah of 234 should be required, or executed in any reasonable time. Pray think for Bengal alone what room would be requisite for the very plans of every village and their separate fields, etc., etc.

Yet the Court say that if the additional revenue acquired be equal to the expense of the survey they are satisfied; but I must drop the subject till I am able to attend to business[5].

Wide as was Mackenzie's experience, he had little knowledge of revenue administration in Bengal, and he had nothing concrete to recommend. After his death Hodgson proved more helpful, and with his advice survey was started in several districts of the Upper Provinces during 1822. Government wrote to the Directors in December 1821 pointing out the magnitude of the task;

A supply of European officers...on an extensive scale could not possibly be obtained...with the existing complement of officers, and it was on all hands agreed that each surveying party must be superintended by at least one European officer of experience. ...

Considering the great extent of country to be settled, the vast number of villages to be separately surveyed, the variety of tenure, ... the intermixture of private properties and of

[1] B to CD., 1-11-16 (38); *BRS.* (339–40). [2] CD to B., Rev., 2-4-17 (69–72). [3] Bombay eventually came to a similar conclusion (173–4). [4] BRC. 22-12-20 (18–26); *BRS.* [5] DDn. 154 (119–20) 21-1-21.

revenue divisions, it is plain that the projected survey will be the work of...years. Your present Government must content itself with commencing the undertaking; the completion ...must be left to the persevering exertions of successive Governments. ...

Chiefly from the debility of bad health and the pressure of immediate duties, the late Surveyor General remained, up to the period of his death, unprepared to urge the prosecution of any specific plan for the survey of the Ceded and Conquered Provinces[1].

MISCELLANEOUS SURVEYS

The first important revenue surveys carried out in Lower Bengal were those of the Sundarbans and of the "Bullooah"[2] salt agency tract, but work was also going on from time to time in the Twenty-Four-Parganas—Cuttack—Dacca—and Chittagong. Surveys followed in Sylhet and Assam.

There was continual extension of cultivation in the 24-Parganas, especially towards the Sundarbans, and in 1817 Government allowed the Collector to engage surveyors for measuring plots of lands to be granted to new applicants;

It would be advisable to employ country-born surveyors instead of Europeans...whenever he shall meet with persons qualified for the duty. In the meantime, the...Council adopts your suggestion for granting to Mr. Blechynden[3] an additional allowance of 100 rupees[4].

Land in the immediate vicinity of Calcutta, and within the city limits, was held on special terms, and detailed surveys were necessary on every change of ownership [I, 139];

Within the limits of Calcutta and its vicinity there was no middle party between the officers of Government and the immediate occupiers or cultivators of the lands. In the report dated 3rd February 1818...the acting Collector...says, "It was to check the frauds prectised by the native aumeens that I was principally induced to propose...the present establishment of European surveyors". ... He had previously [written]...1st December 1817, ... "The establishment of European and country-born surveyors...has...been attended with great public benefit. ... A system of fairness and integrity has been introduced...which has given confidence to the pottah-holders, and makes every proprietor of ground within the city...anxious to have his property measured and registered in his own name". ...

We are glad to learn...that in these pottahs an example is exhibited of...a complete specification of the lands—"the exact measurement of the ground bought or sold; that is, the quantity of begahs or cottahs—the length and breadth—the boundaries, north, south, east, and west—and the person by whom the measurement is made"[5].

The first attempt at a revenue survey in Cuttack was an experimental survey in Khurda *pargana*[6] [18], of which Buxton writes;

It had been long thought desirable that a map of a portion of the district should be prepared on a larger scale, and on a more detailed system, than had been usually adopted in common surveys, with a view to assist the revenue officers in the collections and settlements, ... and accordingly in November 1820 I was instructed...to commence a detailed survey of the small district of Khoorda, forming one of the most southern divisions of Cuttack, and containing about 500 square miles.[7] ...

Having first established triangles connected with those of former seasons, I had, with the aid of the two apprentices [17 n.9], ... completed...about one third of Khoorda, when sickness put a stop to my progress in the month of February 1821, and has since prevented me from resuming the survey[8] [18].

The survey was abandoned and the assistants moved to the Upper Provinces;

The villages in the Khoorda District are small and poor, and...not...much advantage to the revenue is likely to occur from the detailed survey. ... The Moradabad and Bareilly surveys are of more consequence than that of Cuttack, and...to them, and to the Goruckpoor survey, the best means should be afforded. ... The apprentices...may be withdrawn from Cuttack for the purpose of being sent to Rohilkund[9] [154].

Government agreed and reported to the Directors that

[1] B to CD., Rev., 28-12-21 (6-9); *BRS.* (284-5); cf. BTC. 7-9-21 (30). [2] Old name for Noākhāli District. [3] Richard, father of James [52]. [4] B Rev Bd. 2-9-17 (33). [5] CD to B., Rev., 21-3-21 (14, 15). [6] 25 m. sw. of Cuttack. [7] proposed by Commissioner, 12-8-20; BTC. 17-11-20 (128). [8] DDn. 196 (136), 13-9-21. [9] from SG., DDn. 196 (133-5), 3-11-21.

the Cuttack survey was, indeed, originally designed as an experimental measure ; ... but the surveyor being chiefly engaged in the wild, mountainous, or woody, tracts, wherein the labours of the husbandman shew themselves only in scattered patches of cultivation amidst a general waste, his operations afforded no light as to the course to be followed in other parts of the country. ... This survey was, moreover, impeded, and has since been suspended, in consequence of the bad health of the officer appointed to conduct it[1] [18].

European surveyors were employed under the local revenue officers in other areas. Between 1824 and 1826 Henry Tanner, in charge of the " invalid thanas " was employed in Bhāgalpur to survey the limits of lands allotted to invalid pensioned soldiers[2], and later in the Rājmahal Hills of the Santāl Parganas to survey the Government estate, Dāman-i-koh[3].

Independently of the Damunikoh, the revenue surveys of resumed...lands are so frequent and extensive as to occupy nearly the whole of Captain Tanner's time for the year round. ... Captain Tanner has been required to survey preparatory to assessment thirty mehalls ; ... thirteen of these...contain somewhat more than 43,000 beegahs[4].

Tanner was not a highly skilled surveyor, nor was his survey which dragged on after 1830 particularly accurate, though it remained the sole authority for revenue purposes for many years[5].

During 1828–9 the Collector of Bihār employed a Mr. Beauchamp to survey village boundaries and limits of cultivation[6] ; and he was still employed as " surveyor to the Bahar collectorship " in 1836[7].

After the occupation of Arakan the Commissioners in charge tried to get a trained surveyor to make a "revenue survey" of the province. No military officers could be spared, and though, Horatio Nelson, an assistant from the Delhi survey was detailed, and special allowances approved, he managed to get his orders cancelled, and never joined.

NOAKHĀLI & CHITTAGONG, 1821–9

The primary purpose of Cheape's survey of Chittagong, 1814–8, had been to aid the settlement of revenue [II, 178], and his final report indicates the value of a careful survey, even on so small a scale as one inch to a mile.

The estimate of quantity of cultivated land annexed to the map has been deduced from the protractions of the survey. ... Cultivated land...997·8125 square miles, or 1,00,612 doons—

(1 kanee = 144 × 120 feet = 17,280 sq. ft. — 16 kanees = 1 doon = 2,76,480 sq. ft. —1 sq. mile = 1613 kanees, or 100 doons 13 kanees...)

By measurement of year 1802, land paying revenue	doons	58,056
and waste land susceptible of cultivation	„	3,452
Deduct Hattia and Sundeep, which are not included in my survey	„	9,571
Total area of low cleared land, exclusive of Hattia & Sundeep, by measurement of 1802	„	52,027
Ditto, by my survey	„	1,00,612
Difference, not paying revenue	„	48,585
The District pays at present (1817), according to assessment of 1802	Rs.	5,73,000

It thus appears that my survey gives a surplus nearly equal to the whole content at present paying revenue. ... I...consider it impossible that there can be more than one tenth, or 100 miles, either above or under the actual area which should pay revenue ; and therefore, deducting 100 miles for any possible errors, ... there will remain 900 miles area which there can be no doubt is within the mark, and if assessed up to this calculation the revenue would be increased upwards of one half of what is paid at present.

[1] B to CD., Rev., 28-12-21 (10). [2] BTC. 30-1-24 (13). [3] *Imp Gaz.* XI (131). [4] B Rev Bd. 9-2-27 (64). [5] ib. 17-10-26 (14) & BTC. 2-3-30 (4), etc. [6] B Rev Bd., 27-2-29 (61). [7] Willoughby Geo. Beauchamp (1800-41); Ben. Inf. 1818; ret. 1824, and settled at Monghyr till death.

I have made this remark of deducting one tenth adverting to the impossibility of perfect correctness, ... and it would seem desirable, and indeed equitable, to guard against the possibility of any estate being assessed as larger than it is. Attention to this point I should conceive very necessary to obviate disputes and complaints, as well as to give general satisfaction. ...

It has been generally supposed that the quantity of cultivated land has been of late years prodigiously increased by...bringing what was formerly jungle into cultivation. ... I am however well convinced from my own observation that the district has undergone little change...for the last 30 years at least, and probably much further back. Indeed, in the map which existed before my survey, I can trace the routes through the whole of the northern parts of the district. ... For a material increase of revenue it will be necessary to look for such increase from a revision of former measurements, and not from any partial measurement of...lands...as have been of late years cleared. ...

Cultivation has been everywhere pushed as close to the hills as possible. ... New tracts might certainly be struck out between the ranges of hills...and some portion of low land will always be found between two ranges.

In addition to the limits of cultivation Cheape surveyed and mapped the boundaries of *thanas*[1].

An important source of revenue was the tax on salt and firewood produced along the banks and islands of the Meghna, the Sundarbans creeks, and the Chittagong coast. Survey had been carried through these "salt districts" during 1802–4 by Thomas Robertson [II, 13–4], but these coastal and tidal regions are continually changing and another survey was authorized in 1821. A civilian surveyor, Henry Osborne [12] was engaged by the Collector at Noakhāli;

Mr. Osborne should first be employed in making a survey of the islands in the Megna. ... It will be his principal duty to ascertain churs[2] as they exist at present, and...to notice any churs of recent formation, and to collect...every information regarding the date of their being first cultivated. So soon as any part of Mr. Osborne's survey is completed, it is my intention to contrast the information he has collected with maps of older date, as well as with all old records and oral information that I may be able to obtain, as by this means I shall hope to be able to distinguish the objections which knavery and artifice will be constantly contriving to defeat my enquiries[3].

The Board of Revenue added the following instructions;

The surveyor should be directed...to lay down all existing mouzahs or villages, townships or kushbahs, hamlets or chucks, hauts[4], ... large or small, occasional and permanent, market places. ...

It is still not intended...to restrict you from dispensing temporarily with a survey in cases where the property in the land is decidedly vested in the Government, and where the peculiar local circumstances may enable you to define limits with sufficient accuracy[5].

Osborne was not satisfied with the terms offered and the survey was taken up from 8th February 1822[6] by Benjamin Blake [II, 382], who was

in the first instance to be employed...defining accurately the boundaries of the salt and fuel lands required for...the Salt Department. Adverting to the scattered direction in which the salt and fuel lands are situated, ... it is desirable to ascertain how far...this duty...will interfere with the geographical and topographical survey you have been directed to make. ... Pending a reference to the Board...your services can be usefully employed in surveying that part of the district which lies between this place [Noakhali] and the great Fenny River. ... In making this survey, the object of which is to define by accurate measurement certain lands formed by the alluvion of the sea, in order to their future settlement, you will...lay down the boundaries of all lands now in actual cultivation, and of...waste, as well as the limits of...lands which are now in the occupation of, or may be required for the use of, the Salt Department[7].

Blake surveyed the Salt Agency lands as he came to them in the course of his general survey of the district, and in October sent in

a map reduced from the topographical one; also an outline of a statistical synopsis of the churs, mouzas, &c., measured during the latter part of last season, being the commencement of a survey of the district of Bullooah [136 n.2]. ... The areas inserted...are all bonafide good soil, available for either agriculture, salt, or...the production of fuel. ...

[1] Report dated 14–10–10, attached to map, MRIO. Misc. 20–0–19. [2] Islands formed by river silt. [3] from Collector, 28–9–21; BTC. 23–11–21 (22). [4] markets. [5] ib. (32). [6] BRC. 8–2–22. [7] from Collector, 15–4–22, BTC. 10–5–22 (16).

A great evil exists in the superabundance of tanks ; ostentation and a love of fame appear to be the causes. ... The forming of a new tank should be prohibited, unless security be given to keep it clean and in good repair, for otherwise they are neglected, and soon become choked up with aquatic weeds, thus engendering...a vitiated miasma. ...

I have been prevented from filling up the columns of the statistical table for want of an assistant, as the whole superintendence of the measurement falls upon me and, with the laying down thereof on the map, occupies all my time. ... Under these circumstances I...may be permitted...an assistant, and...recommend Mr. James Thompson, lately employed in the revenue department under Mr. W. Fraser in the Dehlee Territory. ... Mr. Thompson will be happy to perform the duties...on the same salary as is allowed to Mr. Jones, the assistant to Ensign Prinsep on a survey similar to that of Bullooah [141–2, 369][1].

He asked for an elephant which was essential for travelling about, whilst a great deal of the work had also to be carried out by boat, which added considerably to his private expense, especially as he lost one in a storm ;

Having in vain waited for tidings of an European built boat belonging to my surveying establishment which was driven from my schooner during a severe storm on the 27th March last...at the mouth of the Megna, ... I have to request...a remuneration...of my loss sustained, which, including masts, sails, cables, oars, and grapnells, is three hundred and fifty rupees[2].

His progress was commended ;

Captain Blake has effected the survey of 43 churs and mozas, comprising the whole of the churs laying between the Noacolly Creek and the Little Fenny River, with the exception of a small tract. ... After he has completed this duty, he will proceed to survey from the western side of the Noacolly Creek along the banks of the river Megna. ...

The map prepared by Captain Blake and the details of his survey...will doubtless satisfy Government that a more able or zealous officer could not have been selected for this important ...duty ; the information he has collected relative to the churs and mozas surveyed—the quantity of land in each already cultivated and fit for cultivation—how much waste—how much occupied for the use of the Salt Department—and what reserved for fuel—...must render the Collector's duty in assessing the lands an easy and satisfactory task. ...

As Mr. Donnithorne[3] continues to represent the expediency of assistance being afforded to Captain Blake, His Lordship will perhaps...direct the civil Surveyor General to depute a proper person from his establishment[4].

Hodgson, as Revenue Surveyor General [305–6], was unable to provide an assistant, but recommended an increase of establishment and changes of procedure [147, 369–70]. Blake was placed under his professional orders, but had to close down in October 1824 on account of the war against Burma[5].

SUNDARBANS

Accounts are given elsewhere [II, 14–5, 177 ; III, 7, 12, 179] of the survey of the Sundarbans commenced in 1811 by William Morrieson, and carried on by his brother Hugh till the end of 1818. This survey had been started to meet the demands of the revenue officers, and showed all the creeks and limits of cultivation on the one-inch scale. It stretched across the Sundarbans area of the districts of the 24-Parganas and Jessore[6], but left Bakarganj unsurveyed, so that early in 1818 the Collector of Bakarganj pressed for survey;

I have received several applications...for tracts of land on and adjoining the Sunderbans of this zillah. From the imperfect state of the records, ... as well as from my present want of local knowledge, I am unable to ascertain whether the said lands appertain to any estate on which a permanent assessment has been fixed, or are exclusively the property of Government. ...

One of the principal objects in constituting this a separate collectorship being to encourage enterprising individuals to cultivate the waste lands, ... it would...be...of great benefit to cause a survey to be made of the whole of the district, and a copy thereof deposited in the Collector's office. ...

[1] from Blake, Noacolly, 16–10–22 ; BTC. 25–11–23. [2] DDn. 195 (287), 26–11–22. [3] James Donnithorne (1773–1852) ; BCS. 1793–1837 ; Collector Bullooah from 1823. [4] BTC. 2–1–24. [5] Map, one-inch scale, and reductions, MRIO. Misc. 6–0–24. [6] Jessore included the present district of Khulna till 1882, *Imp Gaz.* XV (287).

I am not informed whether or not Lieut. Morrieson, now surveying the Sunderbans, has instructions to extend his survey as far as this zillah; at all events some time must elapse before he will reach it. ... Should it interfere with the arrangements of Government to send Lieut. Morrieson or an engineer officer here, ... the duty might be executed by uncovenanted assistants from the Surveyor General's Office[1].

Again, a year later;

Seeing that Capt. Morrieson, the officer surveying the Jessore Soonderbuns, ... has been compelled to proceed to sea for the benefit of his health [12], ... there is little prospect of the survey being proceeded in immediately. ... The more I see of the nature of this district, the more I am impressed with...the necessity of...an accurate map. ...

A young man named Jackson, a sea-faring man, is willing to undertake the duty on a salary of 200 rupees per month, and about 80 rupees per month boat hire. The duty... could be concluded in less than two years, and the advantage both to the Magistrate and Collector would be incalculable. At present there is no defined line between the districts of Tipperah, Dacca, and Backergunge.

Government consented although not happy about appointing a surveyor outside the Surveyor General's establishment;

It seems likely, however, that a topographical survey of particular portions of the district will be found very useful for...the Collector's office, particularly for making out the limits of estates, and...of lands proposed to be assigned to new settlers.

If therefore Mr. Jackson shall possess the necessary qualifications of a land surveyor, ... His Lordship in Council will...sanction his being attached to the Collector's office on the terms proposed. ... That gentleman is accordingly authorised to employ Mr. Jackson in surveying. ... He will, ... submit a specimen of Mr. Jackson's work at an early period[2].

Jackson was engaged, and on his resignation in July 1820 the Collector submitted his maps and fieldbooks;

The beneficial results...were apparent in the difference of sudder jumma[3] demandable by that process and that shewn by the native umeen, which...did not fall short of sicca rupees 1700 per annum. The former sudder jumma of the estate...was sicca rupees 1165–10–15. The measurement of the umeen shewed...Rs. 4720, more or less,—that by Mr. Jackson...Rs. 6501—and this latter sum the present occupant is ready to pay.

It was not till after I had three several times proceeded...in person, and kept the strictest watch over the aumeen that I got the measurement completed; the time employed...occupied at least ten months, whereas Mr. Jackson's survey was completed in less than a month. ... When it is considered that the proportion of Mr. Jackson's salary did not exceed Rs. 280, and that the umeen received sa. Rs. 560, the preponderance is again greatly in favour of it. ...

The whole expence incurred by employing Mr. Jackson will be most amply repaid by the increase of assessment of the single estate above mentioned[4].

The Surveyor General did not endorse this estimate of Jackson's work;

I have been miserably disappointed as this young man, who applied to me himself, makes such additions to the original allowance that I would not...recommend it without some better assurance of his being competent for the duty. ... For such a survey the fullest allowance of a surveyor would not be too little, and to admit that the duties required of a geometrical survey of islands separated by extensive waters could be done by an ordinary establishment would be imposing upon you and upon Government. ...

It appears to me evidently that what he says was done at an expense of 280 Rupees per mensem was just of as little value as the former expenditure upon a native measurer. Altho' a costly set of instruments was furnished to him, not a single point of observation has been transmitted, tho' it was not too late in the season, and I have just discovered that the plans sent in were, in fact, copied by a not very competent draughtsman belonging to this office[5].

It is obvious that there was urgent need of trustworthy surveys, though possibly not of the high professional standard set by Mackenzie. The supply of competent surveyors was negligible.

The first regular settlement had been started by David Scott, junr., in 1814 [II, 177], and he reports in 1818 that he

found the unassessed cultivated lands...to be of the following kinds—Encroachment by zemindars—Extension of cultivation...beyond the quantity for which they paid revenue—

[1] from Collector, 24–1–18; B Rev Bd. 25–9–18 (1). [2] ib. 23–4–19 (31). [3] amount of revenue due [I, 135]. [4] DDn. 145 (331–6), 14–7–20. [5] DDn. 154 (119–20), 21–1–21.

Reclamation by unauthorised persons who subsequently procured forged documents.

He began by measuring the latter two kinds of land by the agency of amins, and for his guide he had the original leases...whenever produced—the chittas of 1783—and a copy of Lieutenant Morrieson's map. There was much opposition to contend against. The zemindars were all arrayed against him. ... The amins, too, were obstructed in their work, and the aid of police had to be invoked, while fraud on the part of the amins themselves constituted a separate source of danger. ... Mr. Scott, however, succeeded in measuring a large extent of land in 1817, and the operations were continued by Mr. Lind in 1818[1].

In 1818 a special Sundarbans Commissioner took over the settlement[2], and on 16th March 1821 the Government reconstituted the commission, with a survey party to aid it[3]. ... The first and main object was to demarcate by a distinct line public from private property, in order to prevent future encroachment, beginning with the country...which had been surveyed by Lieut. Morrieson. ...

Ensign Prinsep of the Engineers was appointed the Surveyor. ... Mr. Dale took charge of the office on 9th April 1821. The year 1821 was spent in preparations ; ... the operations were steadily prosecuted during 1822 and 1823. ...

They took up the demarcation of the line separating state from private lands, and worked from Pranpur on the river Jabuna westwards. ... Mr. Dale...came to the conclusion that no satisfactory decision could be had till the line separating the forest from the cultivation was ascertained, surveyed, and mapped, and that he directed Mr. Prinsep to do. ...

Mr. Prinsep made a detailed survey of the forest line from...the river Jabuna to the river Piyali during 1822, and continued it to the Hugli, a little below Culpi, during the succeeding year, through a total distance of about 180 miles. He also surveyed the...taluks measured by Messrs. Scott and Lind with the object of testing the accuracy of the amins' measurements as a whole. ... During 1823 he surveyed the 28 taluks that were measured...the previous year. He thus completed 48 taluks, ... and found the amin's measurements fairly correct, except in three instances of jungle where they had resorted to guesswork.

The applications for jungle grants...were also made over to him for enquiry into their boundaries. Using Morrieson's map as his basis, he filled in the khals[4] and other details during excursions by boat. ... In addition, he made a full survey of the strip of jungle bordering the cultivation from the river Bidyadhari to the Hugli, with a breadth varying from one and a half to six miles. ...

His map...shewed the precise situation of almost every important...taluk in the 24-Parganas district, and the exact limit (with the village boundaries inserted) to which cultivation had ...been carried between the rivers Hugli and Jabuna. ... He parcelled the jungle into separate allotments, and gave them numbers[5] [II, 16]. ... He experienced much trouble from the conflicting names given by rival zamindars to the creeks and other natural features, but he gave currency in his maps to the names which the fishermen and wood-cutters...used. ...

Mr. Dale was removed in November 1823, and Mr. R. D. Mangles[6] succeeded him for two years, after which there were several changes until 1828. ... Mr. Prinsep during 1824 partitioned the jungle belt...to the river Jabuna, and was deputed to Chittagong at the end of the year. ... His establishment however was retained, and Lieut. Mallock of the Engineers was appointed Surveyor in November 1826[7] [7].

Mallock was relieved towards the end of 1827, and was succeeded by Alexander Hodges who was given revised instructions ;

The next step should be a careful and minute survey of the line on which the forest and the cultivation meet, from the spot where the former touches upon the Hooghly immediately above Channel Creek, thro' the districts of the 24-Pergunnahs, Nuddeah, Jessore, and Backergunge to the south-eastern termination of the waste upon the sea, ... at the mouth of the great western embouchure of the Ganges, or Pudda.

This survey should be conducted upon such a scale as may ensure it from dwindling down into a permanent sleeping appointment for a single officer. ... It surely cannot be less an object of importance to define the limits of a forest that extends within twenty miles of the seat of Government, than to measure the villages of Bareilly or Goruckpore. ...

It is certain that unless Government are prepared to resign all prospects of deriving revenue ...from the cultivation of Sunderbuns wastes, the survey of those tracts must be undertaken at some time or other. ... Nor do I think that it will be wise to retard the execution of the scheme by fixing the surveying establishment on too limited a scale ; for I have invariably observed in

[1] Pargiter [II]. [2] ib. (14) & *Imp Gaz.* xxiii (144). [3] B Rev Bd. 27-3-21 (56). [4] creeks. [5] Called "Lot No. —" to this day : original plans DLR. 24-Parganas (1-4). [6] Ross Donnelly Mangles (1801-77) ; BCS. 1819 ; *DNB*. [7] Pargiter (15-7).

this country that, whenever operations...have been protracted beyond a certain period, ... the plan has either been abandoned altogether, or has been feebly and imperfectly carried thro'. ...

The survey of the line...has not to commence "de novo" ; the whole western frontier of the jungle from Channel Creek to Hoseinabad...and thence to the south eastward, as far as Prawnpore, having (with very partial exceptions) been...most accurately mapped by Captain Prinsep. ... The *estates* measurement form a connected belt of cultivated land, extending from Channel Creek to...the Pesolee Nuddee, interrupted only at the several spots particularized. ... From Dhosa Ghaut northward to the Bydya Dhurree, thence round to...Hoseinabad, ... and...Prawnpore, the *skirts of the jungle* have been strictly followed by the chain of the surveyor. ...

Captain Prinsep is of opinion that artificial landmarks or boundary pillars ought to be erected to defend new settlers...from encroachment, or the hazard of collusion and litigation with the neighbouring old proprietors. ... Captain Prinsep should...furnish a more formal and detailed report, particularizing what has been already done, ... as well as explanatory of his own views...with regard to the future conduct of the survey. ... No person is so capable of doing justice to the subject[1].

The following is taken from Prinsep's notes ;

When the survey is carried beyond the Eeshmuttee, it will be advisable that a native ameens' measurement of estates should, if possible, preceed the European survey, as it will abridge his labour, and...probably save him from travelling over the same ground twice. A measured belt of estates along the edge of the jungle is, of course, the most desirable kind of survey ; where it cannot be obtained, it has hitherto been usual to carry on a *chain* and...*theodolite survey* along the skirts, noting a number of...landmarks for the topographical delineation of the country, it's revenue divisions, and...boundaries of the villages and estates.

The survey was to be published ;

Much advantage will be gained by the multiplication of the survey maps. ... It seems desirable to vest the duty of preserving and copying the maps in a separate officer resident ordinarily at the Presidency, and the experience acquired by Captain Prinsep in the three years of his conducting the survey...point him out naturally as the person in whom this duty should be vested. ...

With respect to the multiplication of copies for delivery to parties interested, either for production in court, or for any other purpose, ... it shall be competent to any person to obtain copies of such fixed prices as may be determined...in concert with the Commissioner of the Sunderbuns[2].

Hodges was authorized to engage an assistant surveyor on Rs. 250 a month, two apprentices, and a number of followers, and was placed under control of the Surveyor General, who was told that,

the survey having been established for revenue purposes, the revenue authorities...determine... the general objects to which the...surveyor can most profitably be directed ; but if you...think that...they are applying the survey...in a manner calculated to hinder the attainment of the main object, ... you will freely communicate on the subject with Board of Revenue and, if necessary, with Government ; and, as to the mode of executing, ... Lieutenant Hodges must look solely for instructions from you[3].

Pargiter notes that Hodges was

to accompany Mr. Dampier[4] [Sundarbans Commissioner], and survey the boundary of the forest. ... During the early months of 1829 Mr. Dampier defined, and Lieut. Hodges surveyed, the boundary, ... carrying it from the river Jabuna, ... opposite Pranpur, as far as the river Belsawar at its confluence with the river Jeodhara. ... Mr. Dampier, being unable to define the boundary positively, directed Lieut. Hodges to take as the boundary the line shown in Morrieson's map, and complete the survey up to the river Sipsa, while he himself crossed over to the opposite side, and described the limits as well as he could. Lieut. Hodges, however, made no survey of the limits ofthe then waste, but simply copied in his completed maps the line drawn in Morrieson's map. ...

The results of the survey were drawn first...on the scale of four inches to the mile, which were worked down into another series on the scale of one inch to the mile, and from the latter Hodges prepared a map [½-inch] of the whole of the Sundarbans, using Morrieson's map as the basis for the country as far as the river Pasar, and Prinsep's map for the details of the 24-Parganas. It was completed in 1831, and is known as Hodges' Map of the Sundarbans. It shows the boundary of the Sundarbans forest along the whole length from the Hugli to the Megna[5].

[1] from Mangles 7-1-28, B Rev Bd. 1-3-28 (69). [2] ib. (70-1) : fdbks., DLR. 24-Parganas M 7 & 8.
[3] BTC. 30-10-28 (9). [4] Wm. Dampier (1798-1861), BCS. 1818. Comnr. Sundarbans from Aug. 1827.
[5] Maps, MRIO. 42 (18, 20) : DLR. 24-Parganas (5, 6).

The allotments made by Prinsep in the 24-Parganas were incorporated...and the same system was continued as far as the river Pasar, which was the limit of Morrieson's survey ; but he revised the numbering, and reduced the whole of Prinsep's and his own allotments into one series of consecutive numbers from 1 to 234 [141], extending from the Hugli to the Pasar. ...

The whole of the coast from the Hugli to the Meghna, with a breadth varying five to ten miles was copied from Major Rennell's atlas of 1779 [I, 227–9], but the interior details of the forest tract east of the Pasar had never been surveyed. ...

To provide sufficient copies of the map, and render it available for the public, the Government transferred the copyright to a Mr. Wood[1], on condition of receiving 100 lithographed copied free[2].

The following passages are taken from Dampier's report of 25th July 1829 ;

After ascertaining that the Shoora khal extended for some way along the skirts of the jungle, I determined to fix its entrance into the Juboona as the place from whence the survey should begin. From thence I proceeded along the estates...cultivated under Mr. Henkell's grants given in the year 1785 [I, 159] ; the terms...are that the parties have a right to cultivate 1000 or 500 begas within certain named limits. So little, however, were the situations of these boundaries known, that the quantity of land within each of them may be taken at 20,000 or more begas. I did not, therefore, deem myself justified in giving up to the claimants any portion of the waste, but informing them that a request...for a pottah would be immediately attended to, I maintain the right of Government to the heavy jungle[3].

The Henckell grant had been measured in 1815–6 by Arthur Smelt[4] and, according to Pargiter,

measurement had been [previously] made by amins, ... but the amins had been bribed, and the results were untrustworthy. He [Smelt] began the measurement in December 1815 in the west of the district, employing six amins. ... Finding their work generally accurate, he proceeded to the general measurement, putting three amins to each mahal. ... He closed his operations in April 1816, having measured a vast extent of land, amounting to 323, 252 bighas, of which 212, 025 were cultivated. The measurement was by blocks, and not by fields, ... and its celerity and vastness detracted from its accuracy. ...

The figures show that, omitting the jungle, he must have proceeded at the rate of nearly a square mile a day. ... Mr. Smelt declared that the operations had been conducted under his personal supervision, and he felt satisfied of their accuracy[5].

To continue with Dampier's report ;

After crossing the Coolpootooa (laid down in Rennell's map as the Pungaseer), the boundary of pargunnah Jamerah, which borders on the waste up to the Cobudduck[6], was regularly defined, although...I found some difficulty in penetrating the grass jungle which formed a broad belt...along the heavy waste, and afforded cover to every species of wild animals.

Upon reaching the eastern bank of the Cobodduck I endeavoured for some days to make my way to the actual Soondurbun waste, but found it perfectly impossible. The lands adjoining the jungle had been gradually deserted, and of places which appear in Captain Morrieson's plan far within the cultivation, I in vain looked for any trace. ... I really had no idea of the rapidity with which all traces of cultivation could be obliterated. Vegetation had sprung up so rapidly as to appear almost the growth of a century. I understood upon enquiry this had begun about 11 years since, and owing to the bunds not being taken care of, and the fear of wild beasts, as the jungle advanced, no raiyuts could be persuaded to remain.

Determined to try if there was not some way by which I could reach the limits...I procured some small boats, and proceeded to two small places...which in Captain Morrieson's plan appeared four miles distant from the waste. ... Along the Coyrah Nuddee[7], all the bank of that river, which was clear in 1814, was covered with dense jungle, and the country intersected with numerous khals. ... I found them situated in the midst of this jungle, the two containing ...about 250 begas, in which were 10 cottages. Extreme unwillingness to quit their houses had detained the inhabitants, ... but they declared it impossible by their own exertions to check the progress of vegetation, and said they must quit the spot very shortly.

There not being any possibility of my fixing the limits of the waste from personal observation, I determined upon directing my surveyor to proceed at once...to the banks of the Seesah, and to trace the intermediate boundary from the plan made by Captain Morrieson in 1814. ...

[1] George Wood ; 1824, Asst., Govt. Litho. Press, Calcutta ; later proprietor of Asiatic Litho. Press.
[2] Pargiter (23–5) ; BTC. 25–5–30 (7) ; lithd. maps, 4-inch scale, 1829 : 2-inch, 1831 ; *Ben Regr.* 28 (282–304 ; 316–40).
[3] B Rev Bd. 4–8–29 (49).
[4] BCS., Writer, 1805.
[5] Pargiter (8).
[6] Kabadak, 79 F/1–8.
[7] Koyra, 79 F/7.

Lieutenant Hodges informs me he calculates the area of the Soondurbuns, the boundary of which has been already laid down by Captain Prinsep and himself, to be about 4600 square miles, and of that portion between the Horingotta[1] and Megna to be 600 square miles. This latter calculation is taken from Rennell's map, and I can vouch from personal knowledge of the amazing extent to which clearings have been carried since that time, and I think the 600 square miles may be considerably reduced.

SYLHET & ASSAM, 1822–30

Some account has already been given of the settlement of revenues made by the Collector of Sylhet in 1789–90, on which the permanent settlement was based[2] [I, 140]. Since that early settlement, cultivation had widely extended, and much of it paid no revenue; scattered tracts were measured by *amīns*, but their work was not to be trusted, and in 1822 the Commissioner obtained the services of Thomas Fisher, who had been surveying the district boundary, to take out the areas of definite blocks by accurate survey, distinguishing cultivated areas from uncultivated, and thus provide an overall check against the detailed measurement of the *amīns*. The Commissioner did not wish him

to supersede the usual course of measurement in detail by native aumeens, but rather to operate as a check...by enabling me to ascertain accurately the gross contents of any given spot, with the proportion of productive and unproductive land of which it may consist. Were...you to survey the whole of the lands, field by field, it would occupy so great a length of time as of itself to render that plan quite inefficient. ...

The only mode, therefore, ... is to take a pergunnah, or any other portion of land of which the boundaries are known and defined, to traverse the exterior of it as the boundaries may be pointed out to you and, after having crossed it in one or more directions, ... to calculate its gross contents, and to distinguish...productive and unproductive lands.

At the same time this will...give a sketch of the outline of the pergunnah, showing its natural shape and acknowledged boundaries which...may prove a ready means to the Courts of Justice to adjust cases of disputed boundaries[3].

In asking for assistants, Fisher pointed out that

when the decennial settlement was fixed in this district, only the lands at that time in cultivation were assessed, and those called junglah were reserved for future settlement when they should be cultivated. In a period of near thirty years that have elapsed since the decennial settlement...the cultivated tract is supposed to have swelled, while the revenue has remained the same[4].

In May 1823 the Commissioner submitted Fisher's survey of

three contiguous pergunnahs. ... I have withheld this report...in the hope that the native aumeens would complete their detailed measurements ..within a reasonable time, and thereby have enabled me to compare the results. ...

Lieut. Fisher has completed the survey of some other pergunnahs, ... at the rate of 40 square miles a month, which is as much as he can perform. The survey of the remainder of the district will occupy fifty-three months and, as in the most favourable seasons there are but five months in the year, viz. from 1st November to 31st March, in which...operations...can be carried on, ... it follows that the survey of the entire district will occupy a period of upwards of ten years. ... With the aid of four...assistants, the survey may be completed with great accuracy in...three or four years. ...

I consider it absolutely impossible for the details...to be executed by Europeans, viz., registering the name of the proprietor of each field, the quality of the land, and the estate to which [the fields belong], ... facts that must be recorded simultaneously with the measurement, and without which the measurement would be of no use. These...can be done through the intervention of native agency alone. A European would sink under the exertion, were it even in other respects fit employment for him.

But the completion of the survey of the whole district on the plan on which it has been commenced presents many important advantages. ... Had some plan of this nature been adopted at the time of Mr. Willes's[5] measurements we should not now be at any loss to know what lands are included in his settlement [I, 140]. ... The talookdars take advantage of it to

[1] Haringhata, 79 F/15, 16. [2] *Imp Gaz.* XXIII (198). [3] B Rev Bd. 4-2-23 (49). [4] DDn. 212 (493), 18-12-22. [5] John Willes, BCS. 1775.

assert that Mr. Willes included the whole in his measurements, and that they are therefore entitled to hold the whole at their present rate of assessment[1]. ...

I am aware of no plan which, working with natives only, offers a reasonable expectation of... accuracy. The only method usually resorted to of checking the accounts of the aumeens is to depute other aumeens called "purtaul aumeens" to go over the same ground [II, 181–2]. To say nothing of the great additional expence, ... what are the grounds of confidence in placing one native over another ? ... I have had a good deal of experience amongst native aumeens, and I have come to the conclusion that it is...hopeless to expect fidelity from them. ... Measuring lands is looked upon amongst natives as a low occupation, ... depriving us of the service of the more respectable class [149]. ...

I have made it the interest of the aumeens...to be honest, by making their remuneration depend on the quantity of land measured ; but I fear the utmost which Government could allow for this purpose would not even approximate to what it would be the interest of zamindars to pay the aumeen for passing over his land. An aumeen receives twelve rupees for every hundred coolbans of cultivated land. ...

As a further check I require the aumeens to transmit their measurement chittas to me regularly ; those in the immediate neighbourhood...daily ; and those of a distance, every fifth day[2].

Government noticed that

the accounts of the native aumeens...shew a greater quantity of productive land than appears in Lieut. Fisher's survey, which, although not altogether an accurate calculation, is a proof that the aumeens have not compromised the interests of Government. ... Yet there is...some danger lest they may in some degree have overrated the extent of the land.

Mr. Tucker[3] should be referred to the system...pursued by Colonel...Munro in the settlement of the Ceded Districts of Fort Saint George [II, 180–2]. He may there draw useful hints[4].

In December 1823 Fisher's survey was broken off by the Burmese advance into Çāchār, and he reverted to military duty, not resuming survey until 1826 [51–2]. In 1827 he came under the professional orders of the Surveyor General, at whose request he sent a summary of the work already done[5].

He explained that the object of the survey was to facilitate the settlement of cultivated lands omitted at the time of the "perpetual" settlement, and that these were scattered over the whole district in small patches from every estate or the minutest subdivision of property. His first object was to ascertain the gross area of each *pargana* as a check on the native measurers.

Though four European assistants had been sanctioned in 1823, only one suitable person, James Blechynden, had been found, and he was called off to other duty almost as soon as he arrived [52].

In October 1827 Fisher sent in specimen maps produced from the work of the *amīns* and his own survey. The plan compiled from the *amīns*' survey was on the scale of 400 feet to an inch, and shewed every estate, however small, its area and boundaries its owner, *tāluk*, *mauza*, and *pargana*. It distinguished cultivated—waste—and village—lands, and *jheels*. The *amīns*' work was not so reliable as survey by a European, but was quicker and cheaper, and sufficiently checked by the surveyor's gross measure [7].

In his report for 1827–8, Fisher said that he had 23 *amīns* employed under him, and that the north-west area of the district would probably be completed in the next two years. The map he attached was not an exact plan of the *pargana*, but as good a sketch of the relative positions and comparative size of the estates as could be expected from the materials[6]. It was accompanied by references to the *chittahs* filed in the Collector's office [I, 139 ; III, 167].

In October 1829 he reported that the work of the *amīns* had been conducted with the same or even greater success, and that little or no difficulty had been experienced in protracting their survey. Flat shades of different colours were applied to the different *taluks* "to assist the eye in tracing details".

In addition to his revenue survey he kept up a geographical map, controlled by astronomical observations [52–3].

[1] B Rev Bd. 8-8-23 (103). [2] ib. 8-8-23 (103 C). [3] Charles Tucker (1789–1851), BCS. 1804. [4] ib. 30-9-23 (86). [5] DLR. M 70. [6] Fdbks. and reports, DLR. M 413-8.

Quite independently of Fisher's survey in Sylhet, a revenue survey was started about 1827 in the lower Assam valley under David Scott, Agent to the Governor General [64].

The work was almost entirely performed by native surveyors, Bengalees or Assamese. The European surveyor or his assistant marked out the given tract and surveyed the boundary. The interior portion...was entirely filled up by native surveyors, and protracted by the European surveyor or his assistant. ...

The nature of the country and its unhealthiness opposed serious obstacles ; most of the surveyors were Bengalees, who suffered severely from sickness, and thereby the work has been somewhat retarded. The work was very ably superintended by the late Lieut. Bedingfield, of the Artillery, and the conduct of it under Mr. Matthews, the present surveyor, afforded Mr. Scott every satisfaction[1].

METHODS OF SURVEY

The essential task in land-revenue surveys was the determination of the superficial area of cultivated, or cultivable, land belonging to estates, villages, or individuals. For reasons of economy it was important to do as much work as possible by means of Indian measurers, or *amīns*, and to keep European supervision and labour to a minimum. The operation of measurement was simple, and could be carried out by very humble agency, but there were other problems that required the close attention of professional officers of experience.

There was the close supervision and checking of measurements, chiefly to prevent fraud in collusion with the occupants. There was often doubt as to the actual limits to be measured, owing to lack of boundary marks and disputes of ownership. Consideration had to be given to the unit of measure and its relation to accepted local measures, both of length and area, which often varied from district to district. There was also the technical control by high-class instruments that would enable the work to be assembled into a correct topographical map, truly placed in geographical position.

Other considerations which in these days are considered beyond the province of the professional surveyor were—classification of soil and crops, and assessment of revenue according to the value of the produce—distinction of land that was held rent-free—collection of statistical information regarding tanks and other means of irrigation, population, cattle, and other possessions [28, 126, 154].

In Bengal early attempts were made to distinguish between the duties of the surveyor and the civil revenue officers, though far more responsibility was thrown on the surveyor than was later found expedient. In Bombay the surveyors had to propose the rates of assessment.

Town and suburban lands of Calcutta demanded special consideration ;

The tenures are, generally speaking, of trifling extent, frequently less than a begah. Their limits are commonly well defined, the land being almost wholly occupied by houses. ... The parties occupying them have long been recognized as proprietors, subject to a trifling quit-rent. ... Hence the advantages of an European measurement...seemed little likely to compensate the charge ; and to require a measurement as the condition of registry, for the uncertain prospect of discovering an excess of a few yards square, ... would have been harsh and undignified.

The objects of a revenue survey in the mofussil[2] are quite different, ... no conclusion can be drawn from the one to the other[3].

In 1829, Nathaniel Halhed, who had been recently transferred from Morādābād, where revenue survey was being carried out under European charge [154–5], wrote as Commissioner of Chittagong ;

The system...of measuring the lands through the agency of native aumeens is open to very many objections. In the first place the result of the best and most honest measurement is not correct. In the second, the poverty of the people employed, and the small rate of wages allowed them, leads them to take bribes for...fabricated returns.

[1] Thomas Jervis, annex. 2 (6–7). [2] at a distance from the Presidency town. [3] B to CD., Rev., 1–8–22 (17).

It is scarcely possible to find European officers who have the time, the ability, and experience, to superintend and regulate the labour of the measurers under the native system, and to correct the result of each day's work. There is therofore no effectual means of detecting the errors, or of distinguishing those arising out of fraud from those originating in neglect. We are, in fact, now suffering all the evils which might have been anticipated from employing incompetent European officers to superintend measurements of this description.

Suggesting a staff of—1 principal surveyor—2 assistants—3 sub-assistants—6 *tindals*—60 *khalasis*—6 coolies—1 head and 1 assistant *mutsuddie*—with wages totalling Rs. 19,321 per annum, Halhed judged that

the work of a single season would enable the revenue officer...to resume and bring under assessment lands the revenue of which will suffice to cover more than the expence. ... The principal Surveyor should commence a grand round on an extensive scale, the area of which the two assistants and sub-assistants will proceed to subdivide into village circles, separating the lakharaje [rent-free] claim from the khalsa[1].

As regards technical details, the following note was made by Hodgson as Revenue Surveyor General regarding Blake's work in the Salt Agency [141–2];

The map of each chur [141 n.2] should be made separate, and drawn on one side of a sheet of large...paper, and on the opposite side may be written such statistical information as appears requisite. On the back of the paper may also be noted the proof table by the method of traverses and the universal theorem, which...I have adopted in the surveys of...the north-west districts [148], and which is the most exact of any. ... These maps...would form a most useful record, ... and they should be reduced at the close of each surveying season into one general map on the scale of 40 chains to an inch, or other convenient reduction. ...

The Surveyor, ... to close his work accurately by the above method, must be very careful to take all the angles of his circuit with a theodolite duly adjusted, and to measure all the boundary lines by the chain or wheel, so that the content may be obtained in areas which may be reduced to the local measure by the known proportion. This is the proper mode of ascertaining the extent and area of the whole chur, but the interior might be measured by the less rigid modes ; indeed, it may prove...impracticable for the surveyor of the marshy churs to adopt the rigidly exact methods[2].

Less exact methods were followed by Jackson in Bakarganj [143] ;

The river survey is made by a floating line attached to 2 boats ; the leading boat having distended the line drops a lead attached to a float, which has been fixed according to the depth of the river, at the same moment making a signal to the following boat, by which signal the surveyor takes compass bearings of the leading boat. ... Both boats advance, keeping the float line still distended until the following boat picks up the lead, and at the same moment makes a signal to the leading boat to drop a second lead, ... and so forth.

The floating line is 44 fathoms, or 1/20th mile. ... The land survey is made by a chain or perambulator[3].

The following notes from Fisher's account of his survey of Sylhet [147–9] are particularly interesting because he worked out a system independently from the surveyors of the Upper Provinces[4] [158–63]. He himself traversed the exterior limits, whilst his *amīns* made detailed measurement of the interior, so that their work was controlled by the gross area obtained from the exterior measurement. The following are the results of one particular measurement ;

Gross area by European surveyor		acres	6526
Area of cultivated land, by ameen's measurement		„	5004
„ by 1796	„	„	4043
„ Excess, subject to new assessment		„	961

Comparison was complicated because in almost every pargannah there were parcels belonging to other pargannahs, many of them at a great distance, and not included within any of the circuits surveyed.

The principles of native measurement were purely geometrical and, in theory, rigidly exact : but the practice was often, from ignorance, carelessness, or corruption, very imperfect.

The *ameen* used the *nul*, a rod 22½ feet long, and measured up the land by squares, rectangles, or triangles, and computed the areas by multiplying out.

There were 35,000 separate estates recorded in the office of the Sylhet Collector, most of them split into smaller parcels.

[1] B Rev Bd. 7–7–29 (52). [2] from Hodgson, 27–12–23 ; BTC., 9–1–24 (5). [3] Fdbk., MRIO. M 308.
[4] DLR. M 70.

The work of the *jureeb ameens* continued throughout the period of the Burmese war, without supervision, and when [Fisher] resumed in 1826 he started in an area lying between the two completed areas, with the object of measuring the gross contents of full areas as a check.

In 1826 each ameen was, for the first time, furnished with a compass by which he might take bearings to show his course, and make a plot of his work. These compasses were made up with the aid of a Sylhet silversmith ; they were necessarily of inferior workmanship, having...needles magnetized by the single touch, and cards divided to one degree.

Each ameen, of whom there were 20, had to send in the compass bearings and measured lengths of the small circuits, each about ⅓rd of a square mile, with which he covered his area.

The following was a typical season's work. During October and November survey was restricted to the town of Sylhet and its immediate neighbourhood, so that the *amīns* might be instructed in the new method of working with the compass. During the remainder of the season, work was extended, and a total area of 265·55 square miles was surveyed. One *amīn* was detached to Cherrapunji. Part of the district boundary was surveyed, and the work of 15 different *amīns* was encircled and examined by Fisher, who also established a number of test points.

During May and June, after the rains set in, the rivers defining the north-west boundary were surveyed, as they were unnavigable during the dry season. The boundaries of certain *parganas* were defined.

The ameen commenced at the north-east corner of his division, and proceeded to encompass it, measuring as many *dangs* as possible from each station, and working round to his starting point. Each of the little squares, or dangs, includes all that could be taken of one landholder's property. The ameen then subdivided the area into divisions of 50 *koolahs* each, and measured the included *dangs* without the compass, geometrically. Errors made by an ameen could thus located without remeasuring his whole work.

The European surveyor afterwards encircled some particular tract, taking offsets to check the ameen's work ; from his circuit he calculated the gross area by the *general theorem* of Adams.

NOTE. For calculating areas, Gale's Universal Theorem[1] was first employed by Captain Thomas Oliver in the revenue survey of the Dihlee District, and having been highly approved of by the Surveyor General, Major Hodgson, its introduction into all revenue surveys after 1823 was immediately ordered [160][2].

The ameen was on contract at the rate of 12 rupees for 100 koolahs. The cost rate for 1823 came to 10 pies per acre, and to 1 anna 5 pies per acre in 1826. The excess area disclosed in 1823 was 3168 koolahs in a total of 12,035.

The graticule of the two-inch map was laid down from instructions supplied by the Surveyor General.

Units of measure in Sylhet were ;

12½ *haths*	..	1 *nul*	1 *kish*	..	1598.71 square yards
1 square *nul*	..	1 *jate*	12 *kish*	..	1 *koolwah*
4 by 7 *nuls*	..	1 *kish*	1 *koolwah*	..	3 acres 3 roods.

[1] Gale did not originate this theorem, but used it for his system of traverse circuits :–If the sum of Eastings and Westings, line by line, be multiplied by the Northings and Southings (also line by line), the difference between the total north products and total south products will be double the area enclosed. John Gale's *Traverse Tables* pub. 1790 as appx. to *Geometrical & Graphical Exercises* by Geo. Adms, junr.; Thuillier & Smyth (273–86, 291). [2] Cf. *PR.* (32).

CHAPTER XI

REVENUE SURVEYS, UPPER PROVINCES OF BENGAL

Organization — Gorakhpur — Rohilkhand — Delhi — Upper Doāb — Methods of Survey — Units and Standards of Measure — Establishment Roll, 1829.

ONE of the most urgent problems referred to Hodgson on his becoming Surveyor General was the organization of revenue surveys in the Upper Provinces [7], and he put forward his ideas in the following letter.

Let us consider the vast extent of the Ceded and Conquered Districts, which we may do roughly by comparing the small zillah of Furruckabad with the extent of all the others.

The district of Furruckabad is stated to contain 2,800 villages, and to yield a revenue of rupees 10,53,075. Let us consider the...time requisite to make a village survey of it, the number ...of persons required, and a rough estimate of the expense. The last will be considerable, though I have sanguine hope it will be covered by the additions to the revenue expected. ...

Lieutenant Gerard was ordered by the Board of Commissioners to make a detailed survey of one village [II, 180; III, 157]. ... It was a large one, and it occupied him and his assistants about a month. But perhaps we shall obtain a surer scale of comparison from the Broach district, executed by the officers of the Bombay government [II, 188–9 ; III, 169]. ... The Broach district, containing 162 villages, was surveyed by a large establishment of officers in rather more than two years and a quarter. ... The villages are large...and...the lands of one large village will be sooner surveyed than those of two of half the size. ... If we could proceed as expeditiously...2,800 villages might be surveyed in thirty-one years and nine months. ...

Let us...consider what establishment may be necessary for each zillah[1]. Though the assistants may be Indian-born...the superintending officer certainly should be an experienced and skilful British officer. ... An officer...receives during nine months in the year 618 sonat rupees, and for the three rainy months 250 [I, 277]; the average is 526 rupees per month. His duties are laborious and prejudicial to health, and the allowances are not lightly earned. I put down here a rough estimate of the monthly expense of his party.

1 Surveyor	Rupees	526
1 Asst. Surveyor, an experienced country-born man who is also a draughtsman	,,	200
3 Apprentices or pupils, country-born, each 100 rupees ..	,,	300
4 Ameens, or native measurers, at 25 rupees each	,,	100
Moonshee, or writer, and hircarrahs	,,	100
	Total, rupees	1,226

On this scale the yearly expense will be rupees 14,712 and the expense for thirty-two years 4,70,764. ... The cost of stationery and instruments, and their wear and tear are not included. ...

Where are we to find a sufficient number of persons capable of executing surveys of all the districts which are not settled ?

How many zillahs are there, ... and what number of villages are there in each ? ...

With what temper may the natives of Upper Hindostan view this measure, which will necessarily induce a more minute investigation into their claims...than they have been used to ? ... They are high-spirited, but reasonable people if brought by degrees to understand that the measures of Government are calculated for their benefit. ... Still, they are so blinded by prejudice of religion and long usage, as often to misapprehend them.

It is strange, but true, that the more ignorant classes actually and sincerely regard all classes of surveyors as *criminals*, sentenced by government to measure the ground on account of their offences, such being a Hindoo penance [145]. ... Whether it be from fraudulent motives, or whether the inferior native officers and ameens...employed in the measuring of disputed lands, take bribes, or from whatever cause it may arise, I think that the natives often relinquish a claim rather than submit to have the land measured. ... If *one* survey, as an experiment,

[1] or district; for Revenue terms *v.* Wilson's *Glossary*.

were...carried on...after due explanation, ... alarms and suspicions...would be lessened. ... At first the progress of the surveys must be slow. ... Boundary disputes are the great sources of litigation in the courts.

If it should be determined to institute a village survey in any zillah in the Upper Provinces by way of experiment, I can select a former sub-assistant surveyor and three apprentices from the school party now in Cuttack [19][1].

On this advice Government passed their Resolution of 7th September 1821;

Without a minute and accurate survey of the country, there appears to be a very distant and uncertain prospect of ever securing a correct...record of landed property. ... With a survey which would enable the European officer accurately to comprehend the...mofussil accounts, ... the risk of fraud would be greatly diminished. ... Without such a check, all the efforts to arrive at a correct knowledge of the country will probably fail of success. ...

That a survey would excite distrust among the people, supposing it to be conducted with discretion, ... there seems little reason to suppose. No such feeling appears to have been exhibited on the occasion of Lieutenant Gerard's survey [157]. ... In so far, indeed, as it would relieve the people from the...frauds of native ameens, and lead to the knowledge by the Judges and Collectors of the matters on which they have to decide, the operation would be so manifestly advantageous to the community, that...they would soon...appreciate the benefit. ...

With respect to the general expediency...of...a survey...for judicial and revenue purposes, His Lordship is entirely satisfied. The points for discussion are the kind of survey to be undertaken, and the instruments to be employed. ...

A map fixing the...boundaries of each village, and the position of the most remarkable objects, ... would...answer every essential end. ... It would enable our officers to acquire a really familiar knowledge of their districts [274, 276].

If, however, the fixing of the boundaries of individual villages...occasion an inordinate delay, the surveyors might be relieved from that duty, and the adjustment...left to the revenue officers, and to...occasional surveys...when disputes arise. ... The survey might still give roads, natural boundaries, and remarkable objects, with several intersected points in each square mile, the general features of the country being likewise sketched in; and such a survey, laid down on a sufficiently large scale, ... would approximate, at least, to the truth in determining the boundaries. ... The operations...being confined to the general survey of the district or its larger divisions, ... with a minute attention to the topographical features, ... would of course be much more rapid than if they were required to fix the boundaries of each village. ...

A geographical survey of each district, marking the limits of the pergunnahs or other great divisions and the positions of the villages, ... ought certainly to be completed.

In speaking of a village and topographical survey, it is not...the design of Government that these should be conducted separately from the trigonometrical survey of the districts, but only that the general survey should...exhibit the limits...of individual villages, and...cut off all extensive waste tracts. ... The accuracy, indeed, of the detailed survey...can only...be secured by combining it with trigonometrical operations [159]. ...

The acquisition of statistical information, and the preparation of memoirs, ... would be natural adjuncts to a detailed topographical survey. ...

It is...desirable...to associate with the surveyor the Collector or other revenue officer... making the settlement. ... The revenue officers must...be kept in constant communication with the surveyors. ... Co-operation...will particularly be necessary in marking out the limits of villages and estates. ...

Many years must...elapse before such a survey could be extended over the whole of the Ceded and Conquered Provinces, but...His Lordship in Council must be anxious to postpone the permanent settlement of all estates until they shall have been regularly surveyed. ...

Of the Ceded Provinces which first demand attention [II, 26 n.1], the district of Goruckpore and the province of Rohilcund suggest themselves. The past settlements of Goruckpore have been particularly defective. ... This...seems...to stand first...for...a revenue survey. ...

A topographical survey of Goruckpore should be commenced as soon as possible by an European officer aided by an assistant surveyor, two or three apprentices, and the necessary native establishment. ... The Board of Commissioners will...communicate fully to the Surveyor General every information that may...assist...in directing...the Surveyor. ...

Another survey should be undertaken in Rohilcund under the Western Board [at Delhi], and the Surveyor General...after...the experimental operations...will...report how far there may exist the means of advantageously extending the survey to other quarters.

[1] from SG. 20-7-21; BTC. 7-9-21 (27); *BRS.*

All proceedings regarding the revenue surveys should be kept as far as possible distinct from ...the general duties of the survey department. ... Correspondence between the Surveyor General and Government relating to the surveys...shall be conducted in the Territorial Department[1].

Early in 1822 surveys were started in Gorakhpur, Rohilkhand, and Delhi, that in Rohilkhand being split before the end of the year to allow one surveyor in the north division of Morādābād, and a second in Sahaswān to the south [154 n.5].

When Hodgson handed over to Blacker in October 1823 [300–1], he was appointed to special charge of these surveys, with the title of Revenue Surveyor General [8, 305–6], and made his headquarters at Fatehgarh, in Farrukhābād district, so as to be alongside the Commissioners of the Ceded and Conquered Provinces [II, 180]. He held this title till 1826, when he reassumed the office of Surveyor General, retaining charge of revenue surveys until January 1829, when he handed over to James Herbert, who later became Deputy Surveyor General and Superintendent of Revenue Surveys [7–8, 310].

After the outbreak of the Burmese war in 1824, most of the officers on revenue surveys, together with many of their civil assistants and apprentices, joined the military forces as surveyors [52, 65, 68, 333]. Bedford and Wilcox went to Assam—Pemberton and Birnie Browne to Cāchār—Wroughton and Nelson to Arakan. Oliver and William Brown were left undisturbed at Delhi, and survey in north Morādābād was carried on by the district officer [154].

During 1826, Bedford returned to Sahaswān and Wroughton to Gorakhpur, and the following year Browne resumed charge in Morādābād. William Brown started a new survey in Sahāranpur, moving to Bulandshahr in 1828. The settlements and surveys in Delhi and the Meerut Division of the upper *doāb* were now under the control of William Fraser [II, 398], of the Board of Revenue in the Western Provinces at Delhi [364].

By 1829 there were five separate surveys in progress, Gorakhpur, Delhi, Sahaswān, Morādābād, and Bulandshahr. The staff included eight military surveyors, three civil assistant surveyors, 22 country-born sub-assistants and apprentices, and a few Indian measurers [165]. By 1830 they had only surveyed about 3,000 square miles at very heavy expense. Each skilled surveyor in charge was doing too much of the technical work himself instead of directing the less qualified workers [160]. The system was not so economical or practical as that followed by Munro in the Ceded Districts of Madras [II, 180–2] or by Fisher in Sylhet, [147–8], though the surveys were a valuable contribution to the topographical map.

GORAKHPUR

In September 1821 Grant [22] was appointed to charge of the revenue survey of Gorakhpur to work under the Board of Commissioners at Fatehgarh in co-operation with the Collector of the district. His staff was provided by the Surveyor General, who also gave professional instructions. Government directed that

the facts...relative to each village should be distinctly recorded, partly in the form of tables with explanatory notes, and partly in the form of reports. ...

The settlement of each village should be made at the same time as the survey, or at least... the Collector should maintain a constant and close communication with the Surveyor, so as to afford him instant support. ... With regard to the illicit alienations, ... the resumption and correction of them should be kept distinct from the survey, though...the matter...will be...fully ascertained and recorded[2].

Wroughton and two apprentices[3] joined early in 1822, and Hodgson warned Grant not to hurry the work ;

You say that only two apprentices are with Lieut. Wroughton, but even with them you expect to get through 30 or 40 villages per month. ... Though your survey has now more assistants than any other, it is by no means advisable to think of proceeding at the rate you

[1] 7–9–21 ; *BRS*. [2] BTC. 14–9–21 (16). [3] Schencks and Dumbleton [69 n.2, 165, 333].

mention. ... The survey must at the commencement be careful and deliberate. The boundaries of each village must be ascertained by the common rules of land surveying, with...a field book and plan of each village. ...

Hurry and precipitance are above all to be avoided. ... If you can in the outset survey two middling villages in a week, you will do very well. Nay, it is better at first to do still less; provided what is done be well done. You must keep your party together, and remain with it yourself, and devote your whole attention to the duties assigned to you, i.e., laying down and ascertaining the boundaries of the cultivated property and its contents.

I highly approve of your zeal and wish to proceed as fast as possible, but remember, much depends on the beginning of a great work, and too much haste loses time in the end[1].

On his relations with the Board of Commissioners [151], Government made the following rulings ;

Lieutenant Grant seems to have considered his commission as extending to matters with which it was not designed that he should meddle ; and, on the other hand, the Board do not seem...sufficiently aware of the importance of leaving the Surveyor to proceed in a regular and systematic manner, subject to the instructions of the Surveyor-General. ...

The advantages of a survey fixing the limits and extent of individual villages are most important, whether for revenue or judicial purposes; but it is also highly important that such measurements should be connected with the general survey of the district. That connection must be lost if the surveyor be interrupted...and sent to different quarters according to the pleasure of the revenue officers[2].

The village maps were on scale of 8 inches to a mile, with *pargana* maps on one-inch or 2-inch scales [153]. The survey completed between 1821 and 1824 comprised "234...villages, equal in area to 44,480 English acres[3]", at a cost-rate of annas 6·67 per acre, whereas

on the Delhi survey the same charge is...less than 2½ annas [156], but such may be expected... when the villages are large, and where the boundaries are settled by the civil officers previous to the survey, and also where the sub-assistants are more numerous. In future I think a more rapid progress will be made in the Goruckpore survey[4].

Grant went on sick leave in March 1823, and Wroughton, who took over charge, was absent on military duty from December 1824 till 1826 [333–4]. The Surveyor General commended " the personal activity displayed by Lieutenant Wroughton ";

He had not had an assistant, and...only...until lately two rather illiterate apprentices. ... The survey was interrupted by the war but, as an assistant, Mr. Macan, and two additional apprentices[5] have been added to the party, I trust that it's future progress will be satisfactory. ... I have instructed Lieutenant Wroughton not to detach Mr. Macan but...to make his services, and those of his apprentices, available...under his immediate superintendence[6].

During 1827 Wroughton surveyed only 126 small villages on the western border of Gorakhpur in the present district of Basti. During 1828, 308 villages were surveyed, besides a detailed "map of the city, suburbs, and cantonments of Gorakhpur" scale 8 inches to a mile, with information about population, bazars, fairs, etc.[7], Herbert reporting that,

owing to the extreme smallness of the Goruckpoor villages, ... the results of this survey have been purchased at a much higher price than those of any other, while...the revenue officers have not made that use of them they have in other districts.

At this rate there was no hope of any early completion and at the end of 1830, on Wroughton's recall to his unit on his promotion to Captain, the survey was closed down, and the personnel transferred to other districts[8] [334].

Rohilkhand

In December 1821 Bedford and Hadaway [332] were appointed to start an experimental survey in Rohilkhand with instructions from Hodgson ;

[1] from SG. 31-12-21; BTC. 1-8-22 (57). [2] Regn. vii, 1-8-22 (322-6); *BRS.* (357-8). [3] About 70 sq. m., in Amorda *pargana*; maps, 8-inch, 1-inch, and 4-mile, MRIO. 19 [22-8]. [4] from SG. 16-4-27. [5] Jenkins and Wilson [365]. [6] BTC. 19-4-27 (43). [7] MRIO. 185 (24). [8] from DSG. 3-11-30; BTC. 7-12-30 (34-6).

I address you jointly because it is desirable that, for the present, you combine your efforts. ... You have both sufficient skill in land surveying...for ascertaining the boundaries of the villages and large estates, ... to define the rights of Government and its subjects, and to aid the Collector in the approaching settlement. The nicety required in the surveys...in England cannot be expected, ... but you must aim at such approximation as is consistent with celerity of execution. ...

Judging...by the Bombay surveyors, we should finish two villages in a week, ... but I think that when you become accustomed to the business more may be done. ... I rely on your zeal and sagacity for discovering practical means to attain the end. ... Try such methods as you deem expedient, and vary them, and let your reports be full, candid, and explicit. ...

It is for the present advisable not to be too minute in making enquiries, except those relating to the grand end of your operations, the demarcation of boundaries. ... You will...keep notes regarding the nature of the soil, the depth of the wells, the methods of irrigation, ... without appearing to be too prying and inquisitive in the eyes of the people, who are apt to be suspicious of...the most innocent questions in regard to their property, families, or cattle; but an experienced observer may note much, without asking many questions. ...

As to instruments, a supply will be sent with the apprentices, and in the meantime you must go on with those you have, and I shall be glad to know from you what you require. At present the store under my charge is not rich, but a large indent has been made on England [213]. ...

And now, Gentlemen, I will now conclude by assuring you that as these survey are of an experimental nature, and you have the honour of being among the first selected to carry them on, I...feel assured that you will fulfil the expectations formed of you[1].

Bedford and Hadaway started in Sahaswān near the Bareilly border on 17th January 1822, fixing their starting point by astronomical observations. The Collector gave them an Indian revenue officer to assist in boundary settlements,

the most embarassing and least satisfactory part of our labours; ... a subject of no small importance, not only as it may effect the progress, ... but as connected with the welfare of the landholders and the interests of the State, for there is every reason to believe that, were the boundaries of contiguous villages once accurately defined, and not the smallest alteration afterwards permitted, ... the pernicious spirit of litigation and animosity...would soon cease to exist, and much of the land now...waste be brought into cultivation. ...

Uncertain how far we were...justified in attempting a task so delicate and complicated, ... we felt inclined...to interfere as little as possible. ... It soon became evident that, unless some method was adopted to clear the boundaries from...these vexatious and almost endless disputes, the progress of the survey would...be slow, and its results unsatisfactory.

In our early operations we experienced some difficulty in even ascertaining the existence of many disputes until the measurement was actually commenced; this was the occasion of frequent interruptions; sometimes the parties after wrangling for an hour would come to an understanding on the spot, but, when the dispute appeared of an obstinate nature, we suspended the survey and commenced in some other quarter[2].

By the 24th June, when they closed for the rains, they had surveyed 68 villages with their boundaries and the limits of the larger swamps and jungles. There was some discussion as to the statistical information required, and the Board of Revenue eventually ruled that

a map fixing the extent and boundaries of each village, and the position of the most remarkable objects (the general features of the country being sketched in by the eye) would answer every essential end. ... An accurate survey of this nature...should therefore be the chief object of the surveyors, and the acquisition of statistic information should...not...retard...of that object. ... Collectors and other revenue officers must be looked to for...information respecting the rights and privileges of the different classes of the inhabitants, the productive powers of the lands. ...

The surveyors should not...allow themselves to be delayed by disputes about boundaries. Where a boundary may be disputed, it will be sufficient for those officers to mark the limit as pointed out by each of the contending parties, leaving the adjustment of the dispute to the authorities legally empowered to determine it[3].

Village maps were prepared on scale 400 yards to an inch[4], and *pargana* maps 1,200 yards to an inch, shewing village boundaries, with statistical tables for each village.

[1] from SG. 10–12–21; BTC. 1–8–22 (57). [2] Report by Bedford & Hadaway 22–7–22; ib. 19–12–22 (22). [3] WP. Rev Bd. 2–6–22; BTC. 26–9–22 (54). [4] MRIO. 23 (5).

In November 1822 Hodgson reported satisfactory progress and recommended both Bedford and Hadaway for promotion. They had now been joined by Pemberton, Nelson, and three apprentices[1], though both Hadaway and Pemberton had been on the sick list[2]. Hadaway died in March 1823, and Birnie Browne was appointed in his place, taking charge of work in the northern division under the Collector, Nathaniel Halhed[3] [332]. Wilcox joined about the same time. When the surveyors were called away the following year, Halhed carried on the northern survey with a senior apprentice, Alexander Wyatt.

In commenting on Bedford's report for season 1823–4, Hodgson points out the importance of determining

the extent of waste land, both within and without the village boundaries, whether fit for, or unfit for, cultivation. ... Lands which may at some future time be brought into cultivation ...frequently exceed in quantity those under tillage. When they are situated out of the village boundaries, they require a distinct and precise survey, that their limits may not be comprehended with those of other villages. ...

It seems useless to attempt to distinguish the proportion of the two crops, and it is utterly impossible to survey the different holdings of individuals in the village. ... All that the survey professes to do is to determine with the greatest accuracy...the area of all the land which the surveyors understand belong to it, and to distinguish in a...more cursory manner...the proportion of land in cultivation, and of...waste, including sites of houses, jheels, uncultivated jungles, roads, and other unproductive places ; also the nature...and the quantity of each soil, and the means of irrigation. ... The state of the population and the number of cattle are likewise noted, but on these last subjects the surveyors are liable to be deceived. ...

In surveys of this kind many curious particulars of information might be collected, if attention to them did not take up much time[4].

Among the "curious particulars" which Bedford noted were the encroachments of the Ganges on lands surveyed during the previous season, which he illustrated by a special large scale map.

The survey of Sahaswān[5] under Bedford, was now divided between two detachments, one under Pemberton, the second under Nelson. The whole party had also four sub-assistants and apprentices[6], with 32 lascars and followers.

Between the 21st of October [1823] and the 25th June [1824] 112 villages had been completed, and...the fair average progress may be stated at 16 villages per month, the total area being 91·73 square miles, or 50,713 English acres[7].

In September 1824 the surveyors were called off for military duty, and survey was not resumed till January 1827. Hodgson reports in 1828 that

Captain Bedford must be ranked with the most able of the surveyors, and tho' his progress has not been as rapid as that of Captain Oliver [156] and Lieutenant W. Brown [156–7], he has not enjoyed similar advantages, his employment being in a poor country where the villages are small, and the boundary disputes most numerous and obstinate, in fact universal. Instead of finding the boundaries marked out and ready for the chain, the surveyor had to undertake the difficult...task of persuading the litigant parties to agree. ...

The settlements of these boundaries were effected by arbitration and punchaet[8], and... Captain Bedford...has sent...the duplicates of all agreements. ... There appears to be reason to hope that these boundary agreements are considered by the people as binding on them. The boundaries being defined, he could then proceed with safety in his measurements[9].

For the year ending 30th September 1830 Bedford with now a second assistant, Roderick Macdonald, completed 267 villages, area 226¼ square miles, at a cost of

2 annas 1½ pies per British acre, including all expenses of office for maps, plans, and tables, furnished both to the head of the department and to the Collector, about 30% less under cost for the last four seasons, and 30% less than estimate made in 1827, when native surveyors were first employed[10] [161].

Birnie Browne, also, rejoined in January 1827 ;

[1] Polhill, Macpherson and Saxton. [2] SG.'s 20–11–22 ; BTC. 19–12–22 (21). [3] Nathaniel John Halhed ; d. Calcutta 1838, aged 50 ; BCS. [4] from SG. 7–5–28. [5] In 1823 Sahaswān Dist. comprised parts of Budaun, Etah and Aligarh ; *Imp Gaz.* IX (39–40). [6] Polhill, Macpherson, Fitzpatrick, McQueen. [7] BTC. 19–6–28 (38) ; 2-inch *pargana* maps MRIO. 19 (53–4), 20 (4–5), 21 (36–9), 22 (44), 23 (3–6, 46, 52), 24 (49) ; Budaun Dist., 1822–34, ib. 24 (50). [8] village assembly. [9] SG.'s 7–5–28 ; BTC. 19–6–28 (55). [10] ib. 28–6–31 (32).

During his absence, the establishment, consisting only of Alexander Wyatt, an apprentice to Mr. Halhed, and some lascars, was usefully employed by Mr. Halhed. ...

This survey differs from those in Delhi and the Dooab in as much as it was instituted for the special assistance of a most intelligent and active revenue officer, Mr. Halhed, but since his removal[1] it has been turned to the...consecutive survey of the zillah, but considered in this light it must be inferior in progress to the more western surveys, as the assistants are fewer in number, and of inferior description. ...

When Lieutenant Browne returned, an assistant was applied for, and Mr. Robert Terranneau, an uncovenanted person of some experience, was appointed, and on the cessation of Captain Gerard's survey [90], I sent...two boys, Edward and Michael Shiells [165][2].

Browne completed 26 villages by May 1828, and the Surveyor General further accepted the work carried out under Halhed during 1825 and 1826, which included a detailed survey, of the boundary between Morādābād and the hill districts of Kumaun and Garhwāl[3].

DELHI

The various revenue settlements that had been made since 1807 in the Delhi territories [II, 180] had been based on indigenous records and native measurements, with which the Commissioner expressed himself perfectly satisfied ;

All the cultivated lands in this territory have been measured at different times, some twice and some thrice, so that there has been very accurate data for forming the assessment, and scarcely any possibility of assets escaping the cognizance of the European officer[4].

It was now decided, however, that a regular village survey should be made under European management, and Thomas Oliver assumed charge in 1822 [38–9], under the direction of the Revenue Board at Delhi.

At the suggestion of the Board I commenced the survey at Noulutheh, continuing in a southern direction along the bank of the canal [23–4], including eleven villages of Paneeput, three in Soneeput, and three in Gohannah. The latitudes of several of these villages have been ascertained by observations of stars. ...

Disputes concerning boundaries very much impeded the progress of the survey at the commencement, and it was not until Mr. Wm. Fraser adopted measures for settling them that scarcely a village could be completed ; but his assistance was so effective that I afterwards experienced much less interruption, and...completed the survey of 17 villages, containing an area of 7,000 beegahs, and through his early assistance I confidently hope next season to accomplish nearly double that quantity[5].

In forwarding this report, the Surveyor General notes that

Mr. Fraser [151] also proposes...that copies of the village plans should be retained for the use of the division to which the villages belong, and that a corresponding copy be engraved at Delhi upon a copper plate, to be delivered to each village as a proof of right to the lands belonging to it. ... The surveyor will...supply copies of these without...having them engraved on copper ; but if many copies...are required, ... they will be more readily made by the lithographic apparatus indented for on the Honourable Court of Directors [298][6].

Oliver thought that after his survey

no encroachment of any, or much, consequence could be made without detection. It would be easy to have the boundaries defined by small pillars or minars erected at the joint expense of the zumeendars, and the destroying or mutilating of which rendering the parties liable to fine would probably deter them. From the boundary sometimes running through highly cultivated grounds, ... objections might be made by the zumeendars to digging ditches or planting hedges, as it would be destroying part of their most valuable land.

The zumeendars seem desirous to have their boundaries settled and their lands surveyed, which may perhaps be accounted for from the increasing value of their property in consequence of the opening of the canal [24]. ... I had lately had a visit from the Raja of Rewarree, ... to ascertain whether there was any immediate prospect of my being able to survey his lands,

[1] to the Sundarbans [146]. [2] from SG. 7–5–28 ; BTC. 19–6–28 (55). [3] Scale 800 yards to inch, MRIO. Misc. 7–0–26 ; reduction, 4–0–26. [4] Report, 28–4–20, *Delhi Records* ('86). [5] BTC. 19–6–28 (40); general map, 2 inches to a mile, shewing "Shah Nuhur, or Royal Canal"; MRIO. 3 (15). [6] from SG. 18–2–23 ; ib. 27–2–23 (50).

and he seemed much disappointed when I told him that it would probably be long ere his wishes could be compiled with. ...

With regard to the population list, the number of females could not well be ascertained ; particular enquiries were not made as it might have been hurtful to their feelings [II, 367, 418]. ... The villagers often complained of there not being sufficient hands to cultivate the land, and the want of ploughs is felt in almost every village[1].

Oliver started with William Brown and four sub-assistants[2], whilst John Simmonds joined early in 1824. By May 1824 the survey had been split into three parties, but before the end of the year several of the staff had been called off to the war. In submitting maps and tables for 86 villages surveyed during season 1823–4, Hodgson reports that

186,116 English acres...have been surveyed, ... and maps, ... and...tables of each village have been formed, and the expense...for each acre is 2·143 annas [154, 162]. ...

This expense, I hope, will be abundantly repaid. ... The soil and climate of the Delhi districts are good, and the various canals made by the Moghul and Patan Emperors prove what pains were taken to render the vicinity of the capital and the adjoining provinces productive.

The rapid progress made...during the past season is very much owing to the care of Mr. W. Fraser, the 2nd member of the Board of Revenue, in causing the boundaries of the villages to be settled and marked ready for the chain.

Captain Oliver is now making satisfactory progress ; during the ensuing season it is proposed that his operations shall be carried on in a productive...country bounded on the east by the Jumna River, on the south by the city and environs of Delhi, and on the north by a line drawn from Panniput to the eastward till it meets the Jumna[3].

In 1824–5, reports Oliver,

the disturbances in this part of the country[4] prevented our commencing operations till the month of December, but notwithstanding the loss of two months...the quantity of land surveyed does not fall much short of that of the preceeding season.

The total area surveyed amounts to 162,727 acres, the expense from the 1st October 1824 to the 1st of October 1825...giving about 5¼ acres for the rupee. ...

When the survey commenced in 1822 no boundaries were settled, and...progress was excessively slow, only about 40,000 acres having been surveyed during the whole season ; this compared with the progress made during the two following seasons affords a striking proof of the great advantage of having all boundary disputes settled. ...

On an average the survey of each village has taken up about a day and half only, and...it cannot be expected that, after making the various measurements, calculations, and protractions, ... much time should be left for collecting with any degree of accuracy voluminous statistical details[5].

On this Hodgson commented ;

This great increase...is attributable to the exertions of Mr. Fraser...by whose aid, authority, and experience, the boundary disputes were settled, and the villages ready for the surveyors' operations when they arrived at them. ... Greater progress will be made on the Delhi District than in any other zillah. ... The villages are larger and...more easily surveyed than the smaller ; and they are less embarrassed by boundary disputes. ... The country also is fruitful and valuable, especially those parts which are near the canal, and they will become more so. ... The climate, tho' very dry and hot, is comparatively salubrious and allows of greater exertion in the field than in the lower provinces. Mr. Fraser is of opinion that if four complete parties could be employed the whole district might be completed in 5 years[6].

In December 1826 Brown was transferred to Sahāranpur, but with good support from Simmonds the party surveyed 343,299 acres in the *parganas* of Rohtak and Mandauthi during season 1826–7. In October 1829 Oliver handed over to Simmonds, having to revert to regimental duty on promotion to Major [152].

The reduced general maps on scale two inches to a mile are still preserved in excellent condition, and shew village boundaries and topographical detail, with full statistical tables on reverse. They cover " Dihlee Territory ", which included the present districts of Rohtak, Gurgaon, and Karnal[7].

[1] BTC. 19–6–28. [2] Graham, Fraser, Mustie and Gould; Wm. Chick joined during 1822, and survd. the *Jantar Mantar*, scale 40 ft. to inch [I, 150], MRIO. 183 (31). [3] from RSG. 21–4–25; BTC. 12–5–25 (27). [4] due to war with Burma, leading to campaign in Bharatpur. [5] BTC. 24–8–26 (45). [6] from SG. 7–5–28 ; BTC. 19–6–28 (38); Oliver now had 2 mil. assts., 6 sub-assts., and an appce. [7] MRIO. 1 (22–3, 33), 2 (1–9, 13–23, 27–30, 36–9, 51), 3 (1–10, 13–5), 7 (13–6).

The revenue survey of Sahāranpur District, started by Gerard in 1814 [II, 180] and broken off by the Nepāl War, was resumed by him at end of 1815, and after some interruption closed down early in 1819[2] [23]. The survey was mainly of topographical interest, and did not even include village boundaries, but Gerard spent some time on the survey of one village on the lines of the Broach survey [149, pl. 16]. In discussing this experiment Government comments that

Lieutenant Gerard...remarks that it would have taken two years to survey the whole of the Ramdheen's mocurrery in the same manner ; and as that mocurrery is stated to have contained one hundred and seventy villages, yielding annually about rupees 1,30,000 under a light assessment, it may be concluded that he calculated on a progress of eighty-five villages per annum. ...

This result does not materially differ from that exhibited by the operations of the Bombay surveyors and, like the Bombay survey, Lieutenant Gerard's would appear to have been conducted on a more detailed principle than is...contemplated. ...

Had the object of the survey been confined to that of giving the limits of the village lands, with the natural boundaries, roads, and all the most remarkable points, the labour would probably have been diminished one-half[3]. ...

In 1826 it was decided to take up the survey of Sahāranpur on the same lines as other districts, and Brown commenced work in Thāna Bhawan[4] in December.

My first operation was ascertaining the true azimuth, or bearing, of a line from which all the others should be deduced. ... The measurements commenced on the 28th, and continued without any interruption. ... The settlement of boundaries being under Mr. Fraser, I never experienced a moment's delay on their account. ... A few chuprassees...enabled me to procure the zemeendars and others to point out their boundaries and, whenever occasion required, the kanoongoes...were procured to give such information...regarding their respective villages. On an average every village has a disputed boundary, and without Mr. Fraser's assistance I never could have got on. ...

Lieutenant Hodges joined me on the 6th, and Lieutt. Fraser on the 21st January, from which time the survey gradually increased its operations till...the 30th March, and from that date till leaving off on the 23rd May it would have been impossible, with one sub-assistant and four apprentices[5], to have surveyed more. ... 45 villages, containing an area of 45,174 acres, were completed. ... The survey has cost 2 annas and 4 pies sonat per acre[6].

Hodgson points out that Brown's report contains

much useful information expressed in the plain satisfactory style of a practical man who perfectly understands his business. ... The proportion which the cost of the survey bears to one year's rent...is fairly considered ; a just and clear account also is given of the native mode of surveying used by the mirdahs employed by the Collector; and the evils and oppression which may, and frequently do, arise from a system so calculated to create and cover fraud and uncertainty are explained.

The use of the rope jureeb cannot be too strongly deprecated, and Mr. Fraser's substitution of the bamboo rod for the chain, even for the interior survey, must be deemed an improvement. ... It will be remembered that the first reform proposed by the Rajah Tudor Mull, revenue minister of the Emperor Akbar [I, 133–4], was the substitution of the bamboo for the rope jureeb, an implement of all others adapted to cause confusion and fraud. ...

Whatever benefit may result to Government and to the farmers from the surveys in Delhi and the Upper Dooab, they may be mainly attributed to the support and assistance rendered by Mr. W. Fraser, and surely benefit must arise where the revenue officers clear the way for the surveyors, and promptly take advantage of the certain [sure] data afforded to them by the maps and tables. ...

These surveys are perfect in their kind, and there can, I think, be no doubt of the great benefit which would accrue to that fine country, the Upper Dooab, from a settlement founded on their basis, and that the expences of the survey will be amply repaid. ...

The party consisted of Lieutenant W. Brown and two officers, assistant surveyors, and an uncovenanted assistant surveyor, Mr. John Graham, ... and D. Chill, E. French, P. Chill and C. Foy, apprentices, ... with a native establishment of three mootsuddees, fifty-one lascars, and three bildars, besides two lascars and two sweepers for government office tents[7] [165].

[1] The country between Ganges and Jumna rivers above Cawnpore [II, 6, 36–8]. [2] ¼-inch map, MRIO. 26 (16). [3] Resolution of 7–9–21, *BRS.* (292–8). [4] 30 m. S. of Sahāranpur. [5] D. H. and P. Chill, French, Davis, Sanderson. [6] from Brown, 1–9–27 ; BTC. 19–6–28 (57). [7] from SG. 7–5–28 ; ib. 19–6–28 (55).

During 1827–8 work was extended southwards into Meerut district, Nelson relieving Hodges, and Macdonald joining in March 1828.

The tract which was first surveyed, ... connecting with the revenue survey of Dihlee, ... appertains to the districts of Meerut and Mozuffurnuggur. The survey then proceeded northward into the Suharunpoor district. ... A sufficient number of villages have been surveyed ...to keep the collectors of districts employed in settling for a considerable time to come. ...

With the exception of the conduct of the Puthans at Teetroun [411–2], the survey was everywhere treated with proper respect. ... The people have hitherto not appeared much interested regarding the measurement of their lands, altho' they seem to be fully aware of the importance of their boundaries being marked. ...

No attempts were ever made to rob our camp, altho' we were in the midst of Goojurs, whose ideas of meum and teum are said to be worse defined than most others of the Honorable Company's subjects, and which does them considerable credit, as our camp was at all times most open and inviting.

Revenue matters are not in the province of the surveyor. I may, however, remark that no complaints were ever heard, or even a murmur against the tuhseeldars or their people (with one solitary exception at the village of Pindourah). The people had no cause for complaints ; the season was good and the wheat crop uncommonly extensive[1].

After surveying a sufficient number of villages in advance of the settlement, Brown's party was moved to Bulandshahr[2].

METHODS OF SURVEY

Though methods of survey varied in detail from district to district, they were controlled generally by Government Resolutions of 1821 and 1822, and by Hodgson's general supervision [7–8, 149–51]. The detailed measurement of fields and the recording of ownership were left to revenue servants and, after much discussion, the settlement of boundary disputes was declared to be the duty of the district officer.

The survey was essentially topographical with administrative and village boundaries surveyed with precision, and other information sketched in by eye. The following extracts are taken from Regulation VII of 1st August 1822.

The main object...is...a general map of the district, and...separate maps of the villages contained in it.

After any particular tract is laid down, or whilst...in progress, the village survey should be carried on until the whole space included in the general survey is filled up. The result of the village survey will thus be checked by that of the general survey.

In the general survey, the position of each village should be fixed as accurately as possible, some remarkable object (a temple or the like) being taken as the point of observation, and specified as such. ... The limits of pergunnahs should be particularly attended to.

In the village survey, the surveyors are to begin...separate maps of each village, with the boundaries accurately laid down, and four or five points at least in each square mile. The general features of the country, the cultivated, uncultivated, culturable and unculturable lands, the pastures and forests, ... to be sketched by eye. ...

Care will...be taken to distinguish what is actually observed from what is merely sketched in. ... Field measurements by the mirdahs or others may...be carried on at the same time with the survey ; the results to be checked by the surveyor ; but the detail must not be delayed by attempting...too minute a detail. ...

The mofussil revenue officers should attempt...to make out the boundaries, setting up flags or the like where there may not already be obvious...boundary marks. Where the boundary is disputed...the debatable land ought, if possible, to be marked off by a double line, shewing what is claimed by both parties. ... The surveyor is not to interfere with such disputes unless specially authorised, but only to provide the means of their being afterwards settled by the proper tribunal. ...

The surveyors must be careful in all cases to notice the size of the local beegah, and of the standard used in the Collector's office, compared with each other and with English measures. ...

[1] Report by Brown, 22–8–28, BTC. 18–9–28 (33) ; *pargana* maps 1-inch and 2-inch to mile, Sahāranpur, MTIO. 17 (38–45), 20 (6), 22 (32–47), 23 (47) ; Muzaffarnagar, ib., 19 (50), 20 (23, 56–7), 22 (14–7, 29–30, 48–9), 26 (8). [2] 2-inch maps, 20 (24–8, 36–7).

In regard to the rights attached to the land, the surveyors...are not...expected generally to meddle with such subjects. ...

It will matter little whether the minute measurements by the native officers [employed by the district officer] precede or follow the survey ; but...the former course will be best, since ...the native officers will act under the dread of a future enquiry, and...they should be distinctly warned that their statements will be eventually subjected to the test of a regular survey[1].

The native officers referred to included the *kanungo* or district record-keeper, and the *patwāri* or *mirdah*, the village record-keeper.

The Register, or Kanoongo, of the district, though under the zemindar, is an hereditary native officer of importance. His records contain every account relative to the revenue, measurement, and allotment of the land. He also enjoys a percentage (generally 2 per cent) on collections, and a due from every village, with small claims upon cultivators and tradesmen.

The land-measurer, Mirdah, of the district is...of lower rank. His duties, which consist in knowing boundaries, measuring and allotting lands, and settling disputes of cultivators regarding their respective fields, are paid by a small portion of land, and a due, generally of one rupee, upon each village[2].

Grant describes his survey of boundaries in Gorakhpur District ;

I prepared 100 bandrols of from 6 to 9 feet in length, and an equal number of pickets ; the former...for station lines, and the latter for offsets to the boundaries on the right and left of the station line. The bandrols were distinguished by red and white flags, the former...to point out the intersection of the boundaries of two or more of the adjacent villages. ... When the village had been surveyed, other surveys commenced from the intersecting points, and the survey was extended in a similar manner along the boundaries of the adjoining village, each red flag denoting new points whence in succession new surveys should be projected. ...

I prepared about 250 white bandrols and 100 red ones, and they were not more than adequate, as the flags were frequently left standing till the whole of the work had been protracted and mapped, and when it was found that no material error had crept in, and that all parts connected, all the interior and exterior white flags and pickets were duly removed, but the exterior red flags were left standing in the points where the boundaries intersected.

Mr. Bird[3] furnished me with a chuprassie from court, and I also had the assistance of one or two of the Collector's officers to enable me to ascertain the limits. ...

It was indispensibly necessary...to conduct a trigonometrical survey simultaneously with the more detailed operation. The plan...will exhibit the triangles and the corresponding points in the topographical survey. The sides of the triangles do not in general exceed 12 furlongs. The length of the first base is 3600 feet, and of the 2nd 4256. In measuring them four one-hundred feet brass chains were used, and the measurement was considered sufficiently accurate to prevent any perceptible error in the detailed surveys [150].

The stations were distinguished by flag staffs about 40 feet in height. They are designated regulating flags and, being seen from every part of an estate, serve as a check against any error in the measurement. The position of these flags being first marked off on the map, the village in which they were placed was then carefully surveyed, and connected in a similar manner with the next regulating flag. In this manner the whole operation was conducted without any trouble or confusion, and without any material error. ...

For observing the angles I made use of the theodolite which I received from your office. ... In extending the operations through the whole district, it would...be desirable to give the trigonometrical survey all the accuracy which can be obtained by good instruments, and I look forward...to...receiving from England the measuring chains which, at your suggestion, I wrote for, as well as the long expected azimuth circle. ...

If, as was often the case, the villages were small, ... no survey of the interior was considered necessary, as the features of the entire village grounds could be embraced by the eye, nor was it often judged necessary to make any interior survey of villages entirely under cultivation, excepting indeed a survey of the...woods and sites of the villages, when the latter were too far off from the boundary to admit of being sketched in by eye. In most cases, however, besides a careful survey of the boundaries, a survey of the interior was executed.

As the work is sketched and protracted in the field, no other field book is preserved ; the sketch book is to all intents and purposes a field book, and from it memoranda of the offsets, distances, and angles of the stations on the boundaries may be easily prepared[4].

[1] Regulation VII, 1-8-22 ; *BRS.* (358-60). [2] Malcolm, II (13). [3] Robt. Merttins Bird (1788-1853); BCS., arrd. India 1808 : Sessions Judge, Gorakhpur, 1826-8; did much to organize revenue surveys ; *DIB.*
[4] from Grant, 5-7-22; BTC. 19-6-28 (36).

Hodgson comments on the large share of professional survey that fell upon the military surveyors, and their reluctance to depute work to their assistants [151] ;

Lieutenant Wroughton...states that the labour and time taken up in the measurement of interior detail for each village exceeds in a very extraordinary degree that...given to...the boundary. This certainly is the fact, and...a great share of personal labour has fallen on the principal surveyor which ought now to devolve on the assistants, who may survey the interior detail under the inspection of the surveyor.

Lieutenant Wroughton, actuated by a laudable endeavour to attain extreme accuracy, appears to have bestowed the same care on the minute particulars of cultivation, and the... sites of houses, ... jheels, roads, and watercourses, as on the principal outline. ... The total area indeed of the village must be determined with the most srupulous attention to accuracy, ... but it would take much time to survey the details...with the same care, for it could answer little purpose when, ... between the time the survey is made and the time when the Collector makes the settlement, much change in the cultivation may, and probably will, take place. ...

The principal surveyor should attend to the total area and boundaries, and his assistants should under his superentendence survey the gross amount of cultivation. ...

With the village map and tables before him, the Collector has certain information as to the total area contained within the boundary lines, which he can...indentify on the spot, and...can rectify the boundary...and regulate his assessment accordingly. The Surveyor is answerable for the true area being asigned to the space contained within what he supposes to be the boundary, but...the Collector has far more accurate means of discovering what the true limits of the village are ...

In the Delhi survey the boundaries are marked off by the civil officer before the surveyor commenced his operations, ... but...boundaries can be more...speedily defined in the Delhi district, where the villages are very large, than in Goruckpore, where they are small, and the inhabitants litigious, and the disputes many and intricate.

I have directed Lieutenant Wroughton's attention to such points. ... I have also desired him to instruct his subordinates in a better style of drawing, and have sent him a separate map of one of the Delhi villages, and a part of the general map of the season 1824–5 as a model for imitation. He is also instructed to compute the total area by the method of traverses, and I have sent to him 300 lithographed ruled forms. ... The other surveyors are also supplied with these blank forms, by which much trouble will be saved [299][1].

Wroughton writes on 30th October 1827 ;

Your admission of my exertions has fully repaid me. ... This season I think I shall make a very material increase of work indeed, if I have only health and strength ; I shall not be surprised if I double the work of last year. The new mode by the Universal Theorem is rather more expeditious than the one I have hitherto followed [148], and the improvement of Macan and the boys leads me to hope for a very rapid and considerable progress [152].

One thing...stands in my way—the paucity of calashees—...These poor fellows are worked off their legs, and to them I must look for the principal aid. ... Unless the establishment is augmented I feel they cannot stand it out much longer. ... They are on the ground an hour before daylight, hard worked until nine A.M., and again out at 4 P.M. until dark. ...

I have in 10 days, or thereabouts, finally measured and computed...26 distinct mouzas or estates ; if I can only go on as I am doing now, and you will afford me...12 more calashees and 1 more mootsuddee, I promise in return to give a faithful and concise measurement of 300 mouzas for this year. ...

I will send you a village nicely drawn up this week, and computed after your directions by the universal theorem. If you approve it...every plan shall be similarly executed during the ensuing year[2].

The following is Bedford's description of work in Rohilkhand ;

The instruments employed in the field—our mode of laying down the boundaries—and entering the measurements in our field book.

With respect of the first, our stock was very small, ... a theodolite by Harris, an excellent compass by Dollond with sights attached and fitted on a tripod, and a perambulator by Berge on the newest construction. ...

We were doubtful...whether to employ the Compass or Theodolite ; the superior correctness of the latter was certainly a great recommendation, but, as it was both heavier than the compass, and more likely to be injured by a fall when surveying through the thick jow jungles and high grass, ... we ultimately determined to employ the compass, ... experiments ...proving that it could always be depended upon to the tenth part of a degree, or even less.

[1] from SG., 16–4–27; BTC. 19–4–27 (43). [2] ib. 19–6–28 (16).

The want of a chain...where the perambulator could not act...we could only obviate... by procuring a quantity of well twisted hemp cord. ... This we had stretched on tent pins, and repeatedly soaked in a mixture of wax, oil, and rosin, to lessen...it's elasticity and the effect of the dew and atmospheric changes. This line was then...divided into yards, with brass marks attached to distinguish the higher numbers, and...it's actual increase or decrease in length was ascertained by a twelve-foot measuring rod, made of a straight and well-seasoned bamboo, accurately divided by means of a brass scale. With two rods of this description...our offsets were also measured.

In commencing our field work, as soon as the bearing of the flag at the next station was correctly read off, ... and the...needle noted, the perambulator was put in motion, and on notice of a landmark being given by a measure-man (who went on ahead with either the zemindar or mocuddum of the village, ...) the perambulator, when directly opposite the landmark, was stopped, and the number of yards...read off, and entered in the centre column ...directly over the bearing. The distance also of the landmark...was then inserted on the right or left of this column, ... and the field book being read off from the bottom towards the top, ... exhibits the different landmarks and other objects exactly as they were met in the field. ...

On our second survey...we commenced...making a preparatory circuit round the whole of the villages...taking as long lines as possible, and generally contriving to have the stations on the exterior boundary, so as to secure an occasional point in every direction to which we could return, and thus check the shorter lines employed in our subsequent survey. When commencing a fresh survey, we...made a point of introducing two distant main stations of that immediately preceding, ... which ensured the correct relative position of the two.

This mode, combined with repeated intersections of any remarkable tree, or other object, enabled us to proceed with perfect confidence, because, as our rough maps have invariably kept pace with the field work, and every morning's survey now closed into one of our main stations, ... no error could arise without being immediately detected[1].

There was much discussion as to the amount of time to be spent on statistics and disputed boundaries, and it was ruled that the surveyors should concentrate on the preparation of their maps, and only collect such statistical information as fell readily to hand, and that they should survey such limits of a disputed area as would assist the district officer to settle it [153].

As time showed how slowly the survey was progressing in relation to the vast area to be covered, Bedford tried the employment of Indians [390].

With reference to...native measurement of the village details on European principles, I... forward a specimen of the field work of my tindal, as actually surveyed and noted by himself, together with an estimate of the expense of this work by a native party, compared with what it has heretofore amounted to. ...

It appears very desirable that the native surveyor should be able to keep his field notes not only in the English form, but [in English] character, in order that his survey might at once be brought on the map without...their being transcribed. ...

I...propose that the party should be formed as follows ; viz., 1 native surveyor per month st. rs. 16-0-0 ; 1 mate, 8-0-0 ; 3 lascars, 16-8-0.

The object in having a mate attached is that in the event of sickness there may always be one individual properly qualified as to the management of the compass, mode of taking off-sets, &c., to supply the tindal's place, and prevent...the work from being interrupted. I reckon that the above party will survey on an average 5 miles each day, or 150 miles during the month, which gives a result of about 4 annas per mile.

The cost of similar work by European assistants came to about a rupee a mile, without any apparent advantage, as the work...is by no means above the capacity of any intelligent native, and the accuracy of his surveys will be brought to precisely the same closing test as heretofore. But from the increased expedition of native measurement, a still greater advantage is likely to ensue by the accelerated progress[2].

It was not many years before the general employment of Indian surveyors was adopted on revenue surveys in Bengal, as in Bombay [388–90, 392].

A curious experiment was made on the Rohilkhand survey of the effect of rough ground on perambulator measurements. In each case a distance of one furlong was first measured by chain and remeasured several times by various patterns of perambulator. The different types of ground were classed as—even

[1] from Bedford, 22–7–22 ; BTC. 19–12–22 (22). [2] from Bedford, 1–6–27 ; ib. 13–5–33 (52).

ground—uneven ground—ploughed fields with large clods of earth—thick grass jungle—rough, or fallow ground with large clods of earth—sandy soil on river banks. The perambulator measurements varied between 212 and 221 yards[1].

The following extracts are taken from Oliver's reports on the Delhi survey ;

The true direction of several of the station lines...was ascertained by azimuths of the sun, observed with a Berge's theodolite ; the mean of thirteen setts of these observations gives for the deviation of the needle, 3° 10′.

At...the first village surveyed, I found that making one circuit round the boundary was objectionable, as any errors that might creep in could only be detected when the circuit was finished, and...it became necessary to go over the whole again. Ever afterwards, therefore, my plan has been to divide a village into polygons containing 400 to 1000 beegahs ; the lines in the first instance being made to run in the open...part of the village, so that those passing through jungle, which are less to be depended on, might have sufficient check.

From the almost impervious thickness of some of the jungles, great delay was caused by the shortness of the station lines ; often a flag staff 15 feet in length, painted red and white, could not be seen at a 100 yards distance. In such cases the smallest deviation from the perpendicular threw the angles out considerably, and...with the inaccuracy of chain work in the jungle...this part of the work...never closed so well as circuits made in an open country[2].

Unless great attention be paid to the management of the chain, no tolerable degree of accuracy can be expected. The men...have been carefully taught to give the chain... one uniform degree of tension. ... The chains are measured every day, or every other day ; ... fifteen-feet rods are used, ... and...the chains are stretched precisely as when they are used in the field. One inch in every chain is allowed for irregularities of the surface. ...

Eighty villages have been surveyed during the season ; the total area being 1,86,116 acres, or 3,60,321 beegahs of 2500 yards. The expense incurred from the 1st October 1823 to the 1st October 1824 has been sonat rupees 28,071, so that for 1 rupee very nearly 13 beegahs have been surveyed. Nearly five times as much has been done during the second season ; ... the number of hands employed...is not even double. The rapidity of our progress has been owing entirely to...all the boundaries being settled, marked out, and cleared, so that in the field we have had almost nothing to detain us [155].

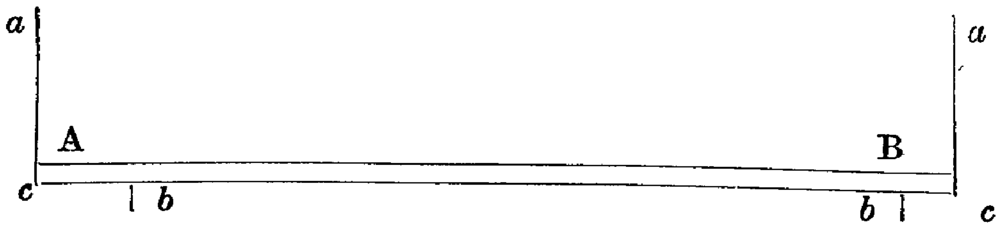
If...the village maps are not so neatly drawn as last year...we have had nearly five times as many, ... and...it was necessary to be less particular about extreme neatness ; ... many...have of necessity been done by young men who have not been sufficiently long practised[3].

The following notes come from William Brown on the Sahāranpur survey ;

In my last report I endeavoured to describe the methods in use among the native land-measurers, or mootsuddies, and to shew how unworthy their operations in general were of credit. ... There are, no doubt, some natives in every office...who are expert calculators. These, however, are not the people I allude to, but those needy men who are picked up at the kutcherry door, who, for 8 rupees a month are ready to undertake the measurement (pymaesh) of lands, and who are accordingly sent out without any previous examination. ...

In comparing their work with...the revenue survey, it can never fairly be done till the mootsuddee measures first. The late Mr. Reade's[4] measurement at Thanah Bhown [157 n.2] is a proof of this ; his measurements were very different from the survey at first ; his people, however, after the maps were given in and areas made known, found out they had been measuring with a short jureeb. It was a cotton rope said to be 60 guz, but the one I measured was less than 52, and might be made either shorter or longer at the pleasure of the mirdha [157, 164][5].

Mr. Fraser has this year made a great improvement in his mirdhas' measurements by introducing...a bamboo jureeb [389] ; the following sketch will assist in explaining it ;



[1] Report by Halhed ; BTC. 19–6–28 (48) ; similar report by W. Brown, Delhi Survey, ib. 10–8–26 (47). [2] from Oliver, 25–8–23 ; BTC. 19–6–28. [3] from Oliver, 1–10–24 ; ib. 12–5–25 (28). [4] John Thurlow Reade (1797–1827) BCS. [5] BTC. 18–9–28 (33).

AB is a stout bamboo about 3 inches in diameter ; a a are two handles each about five feet long, which are attached to the bamboo at c c with a hinge ; b b are two flat pieces of iron, well fixed by nails rivetted on iron plates on both sides of the bamboo, and distant from each other exactly 12 feet. The mirdhas lay hold of the handles, one at each end, and proceed, ... making marks with the flat pieces of iron, which are moderately sharp for the purpose. ...

An iron chain...appears...more liable to error than a bamboo. ... An iron chain stretches 18 inches after being used a short time, and every day they are verified by rods, and corrections made for their difference, and unless the mirdhas are furnished with rods, very accurately measured, to correct their jureeb by, there will be very little advantage gained by their use.

Their measurements are made field by field, and a difference of a few inches on the chain would make a very great difference of area before a tolerable sized village was completed. The length of the bamboo is easier determined, and a short alteration in its length can easily be rectified by a hammer applied to the flat pieces of iron.

A mirdha...is able to measure about 300 kucha beeghas per day[1].

As regards his own survey of Thāna Bhawan [157], it was Brown's intention to have connected the survey with the first station of the trigonometrical survey of the hills at Suharunpoor[2], but...it will be some time before I have that opportunity. The hill of Choor was very conspicuous [30 ; pl. 5], but the station on it being destroyed, and not being certain of the peak, it did not present an opportunity...to determine my position with... accuracy. ... 24 observations for latitude...were made at my other camps for the same purpose. My time, however, did not permit me making observations for longitude.

The stations where three villages meet[3] have all been deduced from the center of the town of Thanuh Bhown, and a table of them made out, from which they were protracted for the general map. ... A table also of the distance on the meridian and perpendicular of the centers of the villages from Thanuh Bhown has been prepared, and from which has been protracted a geographical map on a scale of 4 miles to one inch[4].

UNITS AND STANDARDS OF MEASURE

Reference has already been made to the variety of indigenous units of length and area [137, 146, 148], and there was also the difficulty of providing reliable standards for the British units, the yard and the acre. As a general rule each surveyor had a brass scale, made in England, against which he checked his perambulator and chains. The Collector of every district was supposed to keep a standard against which his staff could check their instruments [164 n.2].

Asked by the Board of Revenue to "prepare for the use of each Collector...a metal rod equal to one English yard, divided into feet and inches, that the length of the native jureebs may be correctly ascertained", Hodgson replied that he had no means nor materials for the construction of such instruments, nor...any artificers. ...

The scales required...could only be well fabricated in England. They should be compared with a true standard at a certain degree of temperature, and the metals of which they are made should be perfectly homogeneous.

It certainly is very desirable that some standard measures should be in the hands of each Collector, and I...suggest...three-feet scales being ordered from England, and also...Gunter's chains...as a frequent check on the jureebs, which from a variety of causes affords uncertain measures. ...

If every Collector's office were furnished with some of the most simple apparatus...partial measurements...might be occasionally executed with facility under the collector's direction. ... The mirdahs might be taught to substitute the chain for their own imperfect and uncertain rope jureebs, the length of which must always vary according to the state of the atmosphere, and the degree of tension applied. ...

If the native measurers could be familiarized to the use of the chain, and...of calculating areas by links, they would readily reduce it to beegahs. ... But even if they were allowed to use their own implements, ... it would be a check on them to know that the collector was in possession of a certain [sure] standard measure, and that he might order...any trustworthy person to remeasure with the chain what they had gone over with the jureebs[5].

[1] BTC. 19-6-28 (57) *mirdaha*, Wilson's *Glossary* (342). [2] Hodgson's survey of 1816-8 [30-5]. [3] Village trijunctions. [4] 2-inch map, MRIO. 23 (47). BTC. 19-6-28 (57). [5] from RSG. 15-4-24 ; ib 7-5-24 (105).

To his offer of chains made up out of local material, Government asked him

to construct for the use of each Collector...2 Gunter's chains of 22 yards[1]. It is hoped that at Furruckabad you may meet with some superior native mechanics. ... You should get from Behar a model of the dhurm lugee[2]. ... It appears to cost little and is said to be very satisfactory. ...

Land measures used in different parts of the country will be found to vary excessively. The guz is not apparently of uniform length; the number assigned to the jureeb varies; the materials are not such as to admit of a nice accuracy, ... and a portion...is often tied up as a noose and thrown round the neck of the measurers. Hence, to say nothing of fraud, the beegah has become a very indefinite denomination. ...

It is very necessary to ascertain...what the extent of the local beegah is; and what the precise length of the local yard or guz; and how many square guz constitute a beegah. ... For all general statements the English acre, and the Bengal beegah of 1,600 square yards, which are readily convertible the one into the other, should be used; and it would certainly be very convenient if, as appears to have been done by Colonel Munro at Madras, the acre could be introduced as the universal measure. ... In the revenue survey of the Ceded Districts [II, 180–2] that officer employed a chain of 33 feet. One square chain being denominated a goontah, 40 of which...constituted an acre; and where fields are small, such a measure might be more convenient than the Gunter chain[3].

Hodgson then suggested the adoption of the old *Illahee Gaz*, as used in Akbar's time, but the Revenue Board thought this impracticable.

The length of the Illahee Guj varies in every zilla. ... It is different in Furruckabad, Ally Gurh, Meerut and Seharunpore, and it is impossible to say which is correct. Thus if Government fix a general standard they must alter the measure in some zillahs and will find infinite difficulty in getting the people to adopt the new one. ... It will be quite sufficient that the surveyors ascertain the exact value of the Illahee Guj in every village[4].

After discussing the length of the *gaz* used by Todar Mal [157], Government directed that, as an experimental measure, a *gaz* equal to 33 English inches should be adopted[5]. The *gaz* was not used everywhere. In Gorakhpur

the beegah is formed by a square of 60 haths, called the Kazy's hath, a varying scale in almost every village, but, from the average of about 200, ... Lieutenant Wroughton...makes out the mean length to be 20 inches and 3½ tenths of an inch, ... which gives for the beegah 1,150·34 square yards, and an English acre contains 4 beegahs 4 biswas and 3 biswansy. ...

The surveyor justly remarks that to have measured each village by its local hath, or what was tendered to him as such, would have been an endless labour, but he has taken the precaution to mention the length in such cases[6].

In discussing the *gaz*, Brown raised the question of the length of the *koss* as determined from distances between the old pillars along the Delhi–Lahore road [I, 247 ; III, pl. 15].

The road distances of the minars are unequal; this may arise either from their not having been originally measured with exactness, or what is likely, from the windings of the road having...been different at the time of the erection of the minars from what they are at present. The mean, however, is 4,557½ yards, or English miles 2,589. ...

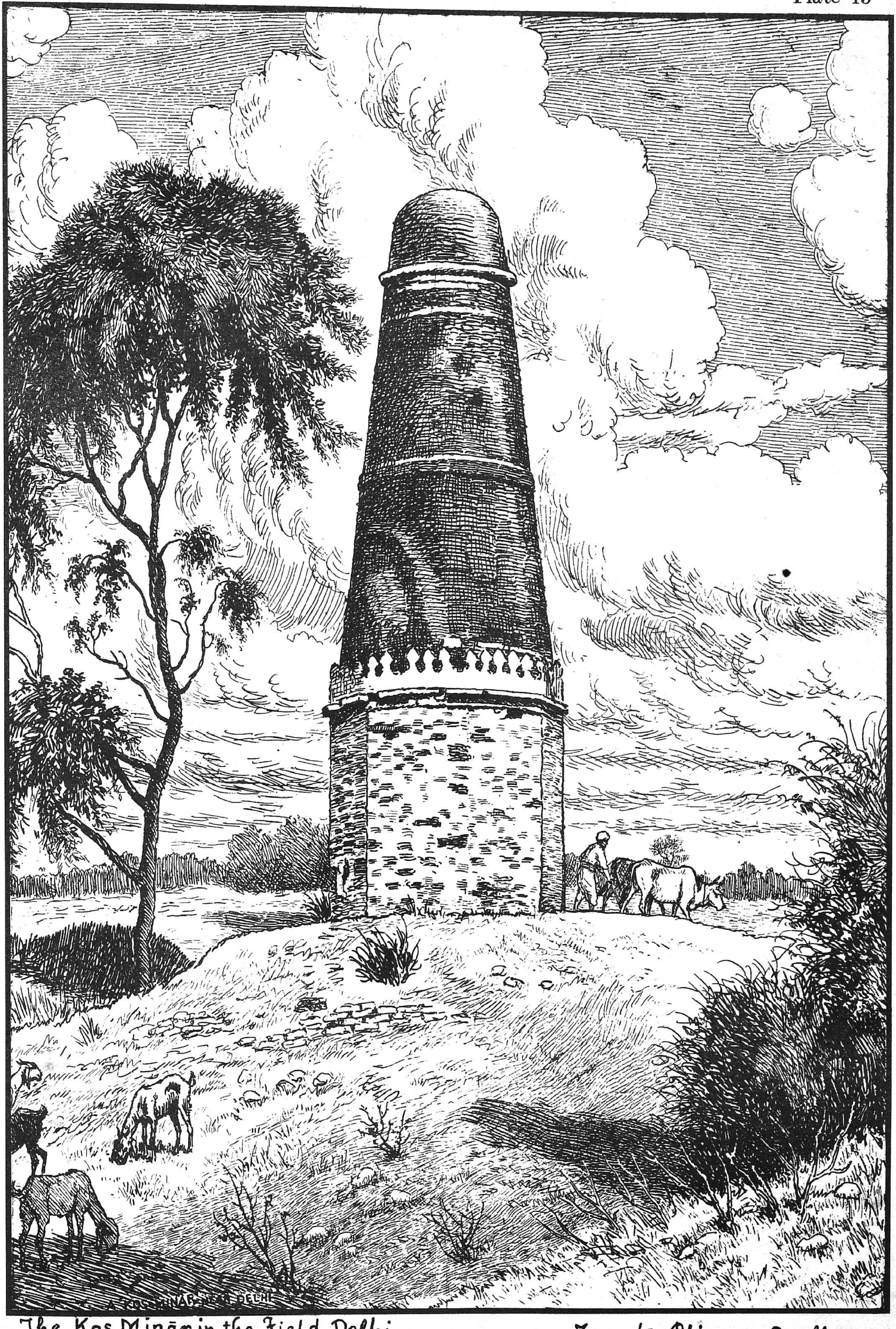
The minars which Lieutenant Brown visited are near Nereluh, one march from Delhi on the Lahore road, but those at greater distances are in general in better preservation. Lieutenant Brown performed this little service with his usual promptitude and alacrity, at a season of the year when the heat is almost intolerable[7].

Hodgson wrote further;

I have since found from the Ayeen Akbaree [I, 133 n.3] that the Royal Coss contained 5,000 guz, and in Rennell's Memoir, page 4, he says "Akbar...directed it to be taken at 5,000 guz, equal to 4,757 yards, that is, about 2 British miles and 5 furlongs. ... Shah Jahan, about half a century afterwards, increased the standard one twentieth part, making the coss more than 2 miles and 6 furlongs. But since the time of Arungzeebe the ancient or common coss has resumed its place, and those of Akbar and Shah Jahan are only heard of in the histories of the times when they were in use [I, 247 n.2]." ...

It will, I think, be right to...adhere to the measurements lately made by Lieutenant Brown, and I propose, as soon as the weather will allow, to employ him in taking the distances of all the coss minars between Delhi and Karnaul, the mean of which ought to be very

[1] named after Edmund Gunter, and used in England from 1620 [I, vi, 198]. [2] legal measuring rod, Wilson's *Glossary*; (137, *dharm*; 306, *laga*). [3] BTC. 7–5–24 (107). [4] WP Rev Bd., 7–6–24; BTC. 17–12–24 (47). [5] ib. 1–6–26 (74–6). [6] from SG. 16–4–27; ib. 19–4–27 (43). [7] from Hodgson, 24–6–25; ib. 27–7–25 (29).



The Kos Minār in the Field, Delhi

Frank Clinger Scallan

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See reverse.

KOS MINĀR

The first *kos minārs* were erected along main roads radiating from Delhi by emperor Sher Shah, who reigned 1538–55.

The length of the *kos* has varied from province to province, and from one period to another. William Brown, revenue surveyor from 1822 to 1844, measured the distances along the Delhi–Karnāl road in 1825, and found those between seven *minārs* to range from 100 to 200 yards more than 2½ miles [164–5].

The old winding roads along which they were first spaced have often been ploughed up into the fields.

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nearly the true length of a Royal Coss by road measure, for it is by that, and not by direct distances, that we must be guided.

Brown took six *minārs*,—one octagonal north of *Nureluh*—one opposite *Nureluh* —one octagonal between *Shalpoor Gredhee* & *Nureluh*—one circular opposite *Aleepoor*, in the ruins of the *Mihr Purwur Kee Sura*—one octagonal opposite *Surushpoor* and one opposite *Shulymar*. Their road distances varied from 4,512·64 to 4,609·66 yards, and the mean gave a length of 32·814 inches to the *gaz*. Hodgson pointed out that some of the *minārs* stood at the edge of the present road, whilst others were half a furlong from it, and that they were probably built at regular distances along a road of slightly different alignment[1].

Boileau records that along the Agra–Delhi road[2] ;

all the road from Koree is marked with milestones, or koss minars, built by Shahjehan along the whole distance from Agra to Delhi, most of which remain entire. The distance from pillar to pillar is exactly 2½ miles, which is therefore the length of the Badshahi Koss, while the ordinary league of the country, or Gao Koss, seldom exceeds 1½ miles. The koss minars are always reckoned by the villagers 1¾ koss apart [I, 247 ; II, 198 ; III, pl. 15n].

Plate 15 is reproduced from a sketch made by Frank Scallan[3] near Delhi. Of these *minārs*, Gordon Hearn writes that the Afghan emperor, Sher Shah, who ruled at Delhi between 1540 and 1545,

built caravansarais at every ten kos distance all the way from Bengal to the Indus, and had wells dug at each kos. He also caused to be erected "koss minars", many of which stand to this day, although the old road has been ploughed up and merged in the fields[4].

ESTABLISHMENT ROLL, 1829

The following is the roll of the revenue survey parties in the Upper Provinces as they stood in January 1829[5];

Sahaswān, or South Division of Morādābād		
Capt. J. Bedford	48th N.I.	Surveyor
Lieut. R. McDonald	1st Extra Regt.	Asst. Surveyor
Mr. J. Fitzpatrick, Mr. A. McQueen		Sub-Asst. Surveyors
„ G. Wyatt, Mr. P. Luckstedt		Apprentices
J. J. Rosse		Writer & Draftsman
North Division, Morādābād		
Lieut. B. Browne	Artillery	Surveyor
Mr. R. Terranneau		Asst. Surveyor
„ E. Shiells, Mr. M. Shiells		Writers & Draftsmen
Delhi		
Capt. T. Oliver	3rd N.I.	Surveyor
„ J. H. Simmonds	26th N.I.	Asst. Surveyor
Mr. J. Gould, Mr. J. A. McPherson, Mr. N. Hodges		Sub-Asst. Surveyors
„ J. Bridge, Mr. G. Comyn, Mr. D. Munro, Mr. C. Bell		Apprentices
Bulandshahr		
Capt. W. Brown	68th N.I.	Surveyor
Lieut. G. J. Fraser, Mr. H. Nelson		Asst. Surveyors
Mr. D. H. Chill, Mr. C. H. Burke		Sub-Asst. Surveyors
„ P. Chill, Mr. C. Foy, Mr. W. Davis, Mr. T. Sanderson		Apprentices
Gorakhpur		
Lieut. R. Wroughton	68th N.I.	Surveyor
Mr. R. Macan		Asst. Surveyor
„ J. Dumbleton Writer & Draftsman; Mr. E. Jenkins		Apprentices

[1] from Hodgson, 29–6–25 ; BTC. 21–7–25 (33); *Kos minārs* are shewn on maps of the Delhi rev. svy., eg. along old road Sonepat-Panipat, MRIO. 2 (15). [2] Fdbk. DDn. 227; M 314, 31–10–28. [3] d. Calcutta, 11–11–50, aged c 81. [4] Hearn (161–2). [5] DDn. 231 (236), 24–1–29.

CHAPTER XII

REVENUE SURVEYS, MADRAS & BOMBAY

Madras — BOMBAY ; Bombay & Salsette Islands — Broach — Gujārāt — Deccan — South Konkan — Appreciations.

THE expensive, albeit reliable, methods of revenue survey under European officers, as employed in Bengal and Bombay, had not been attempted in the south, and the Madras Government resisted all invitations to do so.

Munro's survey of the Ceded Districts by means of closely supervised Indian measurers [II, 180–2] was accepted as the most suitable, but as a general rule each Collector was left to devise his own system for finding the areas of cultivation. District surveys carried out by the assistant revenue surveyors up to 1816 had been little more than useful topographical sketches, and in some cases sadly inaccurate [II, 139–51, 184–5]. The regular topographical surveys carried out under Mackenzie gave the main topographical features and *tahsil* boundaries, and much useful revenue information, but no attempt was made to survey village boundaries, or precise limits of cultivation [II, 214].

In answer to enquiries from Bengal in 1816, the Madras Government expressed the opinion that regular revenue surveys were of little value. They enclosed "papers relating to the ryotwar mode of settlement which have recently been printed here for circulation among the Collectors".

> The survey of the Ceded Districts (the best which has been executed) consisted only of the measurement and classification of the land...by the Collector's own servants without the aid of scientific surveyors. An admirable survey of the same districts, comprising...geographical and statistical information, ... has since been completed by the assistant surveyors under Colonel Mackenzie's superintendence, but, valuable as that survey is for other purposes, it... would be found comparatively of little use in forming the revenue assessments [II, 152–6]. ...
>
> On the subject of revenue surveys, ... generally speaking they have not been found practically useful or fit to be relied on, ... and...the design of prosecuting them...has for a good many years been relinquished by this Government. At present the revenue of all the districts is assessed with little or no reference to the surveys[1].

In 1821, at the instance of Munro, who had become Governor the previous year, a questionnaire on the subject was sent out to all districts and after considering the replies Munro recorded the following minute ;

> Observations on...the surveys of the different districts—on the use of surveys—on the mode of executing them...—on the mode of acting on them when executed—and on the propriety of completing them gradually—
>
> The answers...give a summary view of the state of the survey in the several districts. ... Only a few of the districts had been regularly surveyed; ... in some, nothing has been done ; ... in others, surveys of detached parts have been made ; ... different standards of measurement have been adopted in different districts, and sometimes in the same district.
>
> The main objects of a survey are to record the exact quantity and description of all land in every village ; to ascertain the tenure and rights of the occupants or owners, as well as the rights of Government ; to fix limits and...obviate disputes respecting them ; to establish mutual confidence between the ryots and the Government by shewing each what belongs to it ; to ascertain the grounds of the assessment, not for the purpose of increasing the amount, but rather...to avoid over-taxation ; and, in short, to make what is now vague and fluctuating definite and permanent.

[1] to Bengal, 17–4–16, M Rev Bd. 25–1–19.

But such survey...cannot be made by every Collector. ... It will...be advisable...to undertake the survey...only in the few districts in which collectors may be found capable of conducting it, and to extend it to others...whenever...practicable. ...

A survey has been begun in Chingleput, and one is now making of the lands not included in former surveys of the northern and southern divisions of Arcot. A revision of the assessment is making in North Arcot, and is likewise required in Salem. ...

The want of a regular survey does not...hinder...a ryotwar settlement. ... Village accounts always exhibit the detail of the lands, their distribution among the ryots, their rent, and the extent of the several fields or shares, either founded on estimate, or on some ancient measurement, and from such accounts it has long been the custom...to make the ryotwar settlement[1].

No regular surveys followed, and though much useful survey was carried out by the department of Tank Repairs, it was not of a nature to assist revenue assessment. What appears to have been an isolated experiment is preserved in a four-inch survey of the village of Bulsapaud, in Guntūr Circar, carried out by Marcellus Burke during December and January 1816–7[2].

In 1819 the Collector of Tinnevelly asked the Revenue Board for "an establishment of surveyors, classers, and assessors, for...concluding the survey partially introduced by my predecessor"[3]. A general survey of the district had been completed by Robinson before 1814 [II, 141–6], and at the further request of the Collector Thomas Turnbull made a statistical survey during 1822–3 [II, 146; III, 320, 374].

The experimental survey of Chingleput referred to by Munro was to provide

detailed information...connected with the measurement, classification, and assessment of lands, exceedingly minute; and it would, no doubt, be highly useful to possess a similar account of every village. The labour required, however, appears to render that...altogether impracticable, as the present specimen employed an active surveyor for...upwards of one year and eight months. ... That the putcut plan[4] of ryotwar settlements obviates to a great degree the demand for these very minute details; and the objects of primary importance are so to estimate the value of what belongs to each cultivator...that he shall not be overburthened, ... and that Government, on the other hand, shall not be...defrauded of what it has a right to receive[5].

In 1808 the collector of South Arcot had a survey made of part of his district, which he claimed had brought considerable increase to the revenues[6]. In 1822 a sum of Rs. 27,908 was allotted for a new survey, to be spread over two years. In the earlier survey no measurement had been made of *inām* and waste lands, and the cultivated areas had not been surveyed field by field, but in extensive blocks that included *nalas*, hills, and roads. Fields were not numbered or demarcated, and were almost impossible to identify. Disputes were frequent, and the resurvey was necessary "not only for the security of the revenue, but for the security of the peace, and prevention of litigation". Survey was also extended to the *tāluks* that had recently been transferred from South to North Arcot[7].

BOMBAY & SALSETTE

The regular survey of Bombay and Salsette islands which had been commenced in January 1811 was carried on by Dickinson and Tate with few interruptions. After 1816 the staff was considerably reduced, and Bombay Island had not been completed by 1820 when Dickinson handed over to Tate, who had held charge of the Salsette survey for sometime. Before handing over, Dickinson estimated that survey of Salsette and Thāna might be completed by the end of 1824 but Tate would not promise this unless given more assistance;

This department, which in...1814 consisted of a head with three assistants in Bombay and two on Salsette, all Engineer officers [II, 185–7], was in...1816 reduced to one assistant in Bombay, and one (being myself) in Salsette. In 1817, that assistant in Bombay was

[1] Minute of 10–5–22; *MRS.* (551–3). [2] MRIO. 134 (7). [3] M Rev Bd. 5–8–19. [4] *patcat*, ryot's leasehold land. [5] from Govt. 12–10–21; *MRS.* (553), 18–8–24. [6] M Rev Bd. 5–1–18. [7] from Collector, 10–4–22; M Rev Bd. 9–5, 23–5, & 10–10–22. *North Arcot* I (143).

removed, when the whole...survey of this island fell upon Captain Dickinson himself, whilst I was alone on Salsette. ... Captain Dickinson has been...four...times temporarily removed, ... when the charge of the two surveys has devolved upon me, as at the present period.

Most of the measurement was now carried on by Indian surveyors recruited by Tate after February 1820 [392–3], and his own time was largely taken up with various incidental duties, ... to which the...revenue surveyor of Bombay is at all times subject, such as...reporting upon the merits of all petitions...which are invariably referred for the opinion of the Revenue Surveyor. ... These duties, as they generally require immediate attention, must in a certain degree interfere with the regular progress, ... as in most of the cases...an actual survey and plan of the disputed property are requisite, not forgetting the time...taken up in the investigation of title deeds, and other claims. ...

The time does not depend upon the actual extent of ground to be surveyed, but on the number of distinct properties...which are to be separately measured and correctly delineated. Another serious obstacle...is the frequent disputes about boundaries[1].

After this appeal military officers were appointed when they could be spared[2], and with these and his Indian staff Tate completed his surveys and maps by 1827, when he submitted a

plan of the Fort of Bombay, drawn on a scale 200 feet to one inch, and also one of the islands of Bombay and Colaba on a scale of 1,200 feet to an inch[3].

The former plan has been reduced from the large one...of the Fort, executed in the year 1813 by my predecessor ; it shews all the additional buildings and the improvements made since. ... The works are delineated as minutely as the scale will admit of, and...names and designations are inserted in the references. The whole of the esplanade is also shewn as far as the prescribed boundary of 800 yards. ...

Public buildings coloured red are the property of the Hon'ble Company, with the exception of the Court House and the Scotch Church in the Fort ; also the native school room and the racket court on the boundary of the esplanade. All the buildings coloured black, excepting the sepoys' lines and a few sheds...are the properties of individuals. ...

The topographical plan of the islands of Bombay and Colaba has been reduced from the large plans...on scales of 40, 100, and 300 feet to one inch. It expresses every...feature of ground, ... every street and road, both public and private, as well as all the public buildings, ... and also every detached dwelling house. ... The boundaries of all the villages are also expressed. This plan also shows every object worthy of notice as far as the scale will admit of. All those of a superior structure outside the native town, ... for the residence of European families or the respectable natives, are coloured red. The rest are black.

Having completed the revenue survey of the Bombay division, and the topographical survey of the whole island, which is...on two large plans on the scale of 300 feet to one inch, which will be completed under the superintendence of my successor[4], it remains for me to submit a statement of the work done, and what remains.

For Salsette he submitted

a topographical plan of the Island of Salsette, ... 2,400 feet to one inch, and reduced from the several plans of the revenue survey, ... 300, 400, and 600 feet to one inch[5]. ... It presents an accurate delineation of the boundaries of all the districts, villages and estates, ... together with...every feature...which the scale is capable of shewing. The different villages and hamlets of the smallest size are expressed as in the large plans of the survey. The lands which have been alienated and become the estates of individuals are clearly defined by their respective boundaries being shaded with different colours. Those that are not coloured are the villages belonging to Government[6].

After handing over all documents of the survey to the Chief Engineer's office, Tate left for England on 5th August 1827.

The plan of Bombay was lithographed and published in London, January 1843[7], by Thomas Jervis, who comments that

the survey...surpasses every other throughout India in accuracy, elegance, and completeness. It is allowed by the first judges in England to be one of the most beautiful specimens of topography that they have seen. It was accompanied by a very detailed statistical memoir[8].

[1] from Tate, 31–8–21 ; Bo Rev. vol. 5/5 1821. [2] eg., Billamore & Hart, from Feb. 1826 ; Bo MC. 22–2–26 (70). [3] London, 31–12–29 ; *IO Cat.* (424). [4] Lieut. Samuel Athill (1797–1829) Bo. Engrs., in CE.'s office ; d. Kensington, 19–4–29. [5] Map, scale 3,600 ft. to inch, MRIO. 124 (13). [6] from Tate, 4–8–27 ; Bo RC. vol. 28/181 (35–41) ; *IO Cat.* (424). [7] Reduced copy, Edwardes, facing p. 238. [8] *Bo Geo Soc.* IV (175).

Sir Patrick Cadell says that when he was collector of Bombay in 1905 Dickinson's was still regarded as the standard survey.

BROACH

The revenue survey of Broach was started in 1812, after Williams had carried out the experimental survey of one village [pl. 16]. The Directors were so pleased with the survey of the first *pargana* [II, 188], that they urged Bengal and Madras to take up surveys on similar lines.

The survey of Broach, which distinguishes not only the limits of every village, but the boundary and extent of each field, whether cultivated or not, together with the name of the possessor and the amount of revenue payable, was connected with the investigation of the rent-free lands, and a...resumption of such as had been improperly alienated from the State. The revenue recovered, ... in one small district only, has amounted to an annual income considerably exceeding the estimated charge for surveying the whole district. It is obvious that a survey conducted in this way tends to prevent...litigation, and may be of material use in guiding the courts to just decisions in...claims to disputed property[1].

Survey of the *parganas* of Anklesvar and Hānsot was completed early in 1816 and the records submitted a year later[2], with a note that "in the course of the survey the whole population...were vaccinated against small pox" [II, 363][3]. Government advised the Directors of the receipt of

a volume of plans and statements of all the lands in each and all of the villages of the Broach pergunnah, ... including also a general plan of the pergunnah, shewing the boundaries and relative positions of all the villages. ... General statements of all the lands, ... holders of alienated lands, ... lands recovered, ... payments made in the pergunnahs, and of the population with index, etc. The whole occupying 161 of the largest folio pages.

A volume of plans of all the lands...in the pergunnahs of Occlasier and Hansoote. ... 108 folio pages. ...

Two copies of a general plan of the whole Broach collectorship, shewing its general extent and boundary, as well as the extent and boundary of every village, and their union forming a proof of the accuracy of the whole.

Captain Williams has also formed a topographical map...which includes all the villages, ... not only for our own pargunnahs, but of those belonging to the Guicowar and to the late Poonah governments throughout the whole of the Attaveesy [122 n.3], and the country between the Kim[4] and the Tapty rivers, ... on a very comprehensive scale (an inch to a mile). ...

The mode in which the valuable information...has been digested and brought forward—the plan on which the surveys...have been conducted—the assiduity with which the resources of the several villages have been explored—and the neatness...with which the survey has been executed—reflect the highest credit on...Captain Williams and...his...assistants. ...

For...surveys yet to be undertaken, we have drafted a Regulation[5] founded on the principles on which those of Broach, Occlasier, and Hansoote, have been conducted, ... and under its operation the surveying department will proceed with a greater degree of confidence...whilst the inhabitants will attach more importance to an investigation thus formally recognised[6].

The area covered by the three *parganas*, which at that time formed the whole of the Broach collectorate, covered 430 square miles. The 162 villages contained 22,753 houses, and a population estimated at 97,874. The assessment came to Rs. 10,48,787, derived from 177,055 acres, or 348,845 *bigahs* of productive land, the waste being 96, 726 *bigahs*. The survey took about two years and a quarter, and Williams had from four to six military officers as assistants.

Survey was then extended over Surat and the village of

Kutargum, from the richness and value of its lands, their being entirely cultivated, and in a great degree enclosed, watered, and planted with fruit trees like gardens, appeared to be a good village on which to try the experiment of a very minute survey. Accordingly one was made, and laid down on a scale four times larger than ordinary. Every field, whether of Government or alienated land, was measured separately, and inserted under its proper name, with

[1] CD to Bo., Rev., 2-4-17 (73). [2] from Williams, 29-3-17. [3] Bo. Surveys, vol. 17/1817. [4] 46 C/II, 15. [5] Bo RC. 26-3-17 (13); Bo JC. 24-12-17 (56). [6] Bo to CD., Rev., 31-5-18 (188-96).

the name of its cultivator (in most instances hereditary) in the statement. The profitable trees were all counted, and their number given on both the plan and statement[1].

After 1818 the Broach collectorate was enlarged by the addition of *parganas* Amod and Dehej, and the survey of these was completed between 1818 and 1820 by Cruikshank, Adams, Ovans and Newport[2].

GUJARĀT

In 1813 the collector of Kaira, to the north of Broach, asked for the survey to be extended to his district ;

The...surveys made in the Broach purgunnah may...have familiarised the measure to...the inhabitants ; but in these districts, a great part of which extend beyond the limits of the celebrated survey made in the reign of the Emperor Akbar by Rajah Toodu Mal [I, 134], and no parts of which have been measured since that period, it is possible that the survey may be viewed in an unfavorable light, and render it politic to...insinuate its operation by introducing it among the more peaceable villages, and waiting till the alarm of innovation subsides[3].

Akbar's reforms were now happy memories ;

The original system was that...the Government share of grain was annually estimated and levied in money from the heads of the community...whilst crops were standing. ...

This system was changed by Akbar, whose wisdom saw the strength his Government would derive from a fixed money revenue. By his settlement "a correct account of the boundaries of each village was drawn out, and the whole land carefuly measured. The land was then divided into fixed classes, and each field assigned to one or the other class. ... One third of the gross produce was taken as the rent due by the whole village". ...

Mogul rule was succeeded by that of the Mahrattas who, whatever may have been their merits in their own country, were in Guzerat mere plunderers. Their system was the ruinous one of farming out districts to speculators, and the villages were ruinously rackrented, and broke down under the pressure[4] [I, 138, 144].

Carrying on the survey of Surat, Kaira and Ahmadābād after the departure of Williams in 1821, Cruikshank had in 1824 seven military assistants[5]. In 1821 ; his Indian staff comprised,

1 Head Measurer .. .. .. Rupees per mensem	35–0–0
48 Native Surveyors and Measurers, with liberty to increase that number without augmenting the expense	680–0–0
53 men for carrying instruments, flags, &c., marking, &c. [with liberty as above]	437–1–0
6 or more peons	43–2–0
Office expenses, &c., ... draughtsman and writers	145–0–0
An apprentice from the Charity School	30–0–0
Office Rent, ... Tent and carriage, ... furniture, stationery, drawing implements, common instruments, and contingencies	376–0–0
In each collectorate under survey, ... for bamboos, flags, country paper, additional horse, and contingencies	150–0–0

In reporting on the survey of the Kaira collectorate, Cruikshank writes ;

Prior to the survey no common standard of length of the guntha, or hath, existed, but after a careful and thorough investigation and enquiry by the late Lt. Colonel Williams, the length of the guntha was determined and fixed [164].

The survey was completed...during the years 1820 to 1824...under...Capt. Ovans, ... assisted by Lieut. Keys...and Lieut. Reynolds. ...

Topographical plans of the whole of the villages, both government and alienated, on a scale of 5 inches to a mile. ... Reduced plan of the whole pargana on ¼-inch scale[6].

Melvill held charge in Ahmedābād ;

Survey commenced December 1824, and fieldwork concluded in March 1826. In the khalsa villages a minute measurement was made of every field, but in the talooka alienated villages a general survey of their limits only was taken, and the megrwaree villages left entirely

[1] from Williams, 15–11–18, Bo Rev Bd. 25–1–19; map, MRIO. 124 (16); report by Cruikshank & Ovans, 1817; MRIO. M. 208; plan of Surat city, by Adams & Newport during monsoon of 1817, *IO Cat.* [438]. [2] cf. Umlesar village. [pl. 16]. [3] Bo RC. vol. 90/1813 ; 31–12–13. [4] from C. J. Prescott Sup. Rev. Svy., Guzerāt, 21–3–62, *Bo Govt. Sel.* cxiv. new ser. [5] Ovans, Dumaresq, Keys, Melvill, Newport, Down & Reynolds [343]. [6] Bo. Surveys, 1826–7 (14a).

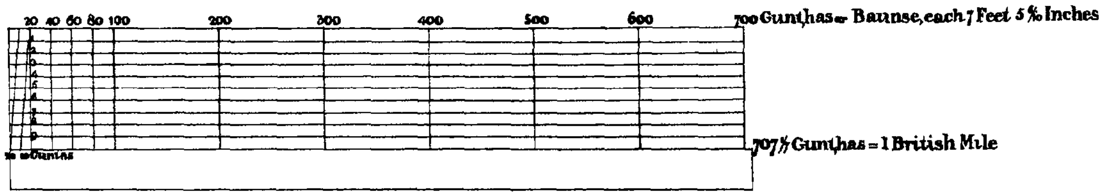
Bhookee Kharee
Byraghees Mut
Burga
Kullee or Barn

Plate 16

PLAN of the LANDS of the Village of UMLESUR, Baroche Purgunna, as Surveyed in March, 1812.

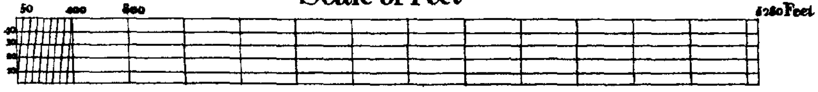
Remarks. The Tullput or Government Land in cultivation is colored Red.
The Alienated Lands are left uncolored.
The Government Land in Grass is colored Green and marked B.
The unproductive Waste Land is colored Brown.
The arable Waste Land is colored Brown and marked Z.
The Boundary of the village lands is marked by a broken Black Line.

SCALE for the BEEGAS and WUSSAS



20 Square Gunthas make a Wussa
20 Wussas or 400 Square Gunthas make a Beega

Scale of Feet



Office of the Survey Department, Baroche, September 1818.

Surveyed and Drawn by
James Cruikshank, Capt: & Assistant.

Monier Williams
Superintendt. of the Rev. & Topl. Survey
Guzerat.

Reduced by one-third from map, scale 6 inches to a mile, prepared from experimental survey carried out in 1812 under Monier Williams and the Collector of Broach [II, 188 n.4].

The revenue surveys of Gujarāt, 1815 to 1828, followed this pattern [169–71].

Reg No 4850 H D '50–800 '51.   Printed at the Survey of India Offices (H. L. O.)

unnoticed. Village plans 5 inches to 1 mile but where waste was extensive scale was reduced to 2½ inches to a mile.

No measurement is known ever to have been made before of this country. ... The tullatees' records were wholly unworthy of notice ; spaces set down by them at 25 beegahs have been found more than 300. ... The want of any information or correct knowledge...relative to the general condition, extent of cultivation, or even the situation, of the villages not immediately contiguous to the kusbas, was remarkable[1].

Survey was closed down in 1827, though Cruikshank was occupied with maps and reports up to 1829[2]. It was found too expensive to be carried further, though Elphinstone noted at the time that

the management of the surveys does not appear to me so injudicious. ... The Guzerat survey, tho' it has cost too much, is not devoid of practical utility, and affords much interesting information, ... [and is] now reduced to a very moderate annual charge[3].

DECCAN

Towards the close of the Marātha war in 1818 Elphinstone pressed the importance of land measurement as a basis for the assessment of revenue, and proposed that, in the area taken over from the Peshwa, measurement should be carried out under the direction of the collectors by native agency with European supervision[4]. *The Imperial Gazetteer* describes how

Revenue, or cadastral, surveys undertaken as a basis for land assessment date from the reign of Akbar, in whose time over 7 million acres in Gujarat were measured in connection with the revenue system of Todar Mal [I, 134 ; III, 170]. In the time of Shah Jahan this survey was extended to the Deccan. The first for which records are available is that undertaken by the Bijapur Sultans at the end of the 16th century. This survey formed the basis of the revenue assessments till 1817, though the original measurements were partially revised by Sivaji as the country passed under the sway of the Mahrathas.

The most successful of the early British surveys was that of Sātāra started by Challen in 1820 [6–7, 125–6], and carried on by Adams[5] ;

When Grant Duff[6] [in 1818] assumed the government of the districts which were to form the future kingdom of Satara, everything was in disorder.

Here, as in almost every other portion of the Peishwa's dominions, the necessity of a systematic survey was early apparent, and survey operations were commenced almost as soon as the ...tranquility of the country was secured. ... In almost every other district of our acquisitions from the Mahrattas those early surveys have proved...worse than useless.

In Satara alone, the survey conducted by Captain Adams...under the instructions of Grant Duff is still the standard authority. ... He saw that almost the only pressing want which a survey could at that period supply was the deficiency, or incompleteness, of records of measurement. ... Boundaries of villages and fields were ascertained and marked—the superficial extent of lands, especially those which claimed to be rent-free, was measured—and of all these particulars careful and intelligible records were preserved. ...

An appeal to "Adam Sahib's survey" or "Grant Sahib's settlements" is, to this day [1876], an end of all strife on any point to which they relate[7].

Grant Duff handed the Sātāra territories over to the Rāja in 1822, but Adams stayed on as surveyor till his death in 1829.

Efforts to start similar surveys were made by William Chaplin, Collector of Dhārwār in 1819, and his successor, St. John Thackeray,[8] who

instituted a detailed field survey on the model of that introduced into the Ceded Districts by Sir Thomas Munro [II, 180–2]. This survey was commenced in a single district under the inspection of Mr. Thackeray himself, ... but his multifarious duties did not allow the supervision...which experience has now proved essential to the successful execution of a survey by means of native agency[9].

[1] Report by Melvill, Jan. 1827 ; Bo RC. 1827. [2] ib. vol. 370/1831 ; report by Principal Collector, Ahmadābād, 11–8–31 ; Maps, *IO Cat.* (436) ; amongst 1833 records, Alphabetical List of Villages, Gujarāt. DDn. 278. [3] *Bo Sel.* CIV. [4] DDn. 114 (114), 6–12–18. [5] MRIO. 122 (2). 124 (29). [6] James Cunningham Grant-Duff (1789–1858) Bo. Inf. *DNB. DIB.* ret. as Capt. 1827. [7] Grant-Duff (223–7) ; cf. *Calcutta Rev.*, 1836. [8] Son of Wm. Makepeace Thackeray (1749–1813), BCS., whose sister m. James Rennell [I, 373] ; uncle of the novelist ; murdered by insurgents at Kittur, 15 m. NW. of Dhārwār, 22–10–24. [9] Report by Wingate, 25–10–44 ; Bo RS. XII. 7–9–53 (9).

Chaplin pushed on his schemes for regular surveys after becoming Commissioner in the Deccan. He describes the usual trouble over units of measure [163–4, 170];

Of land measures in use there is the greatest diversity. Former measurements...seem usually to have been made with a rod...of five cubits and five clenched fists (equal to about 9 British feet), one square rod making a pole ; 20 poles one paund ; 20 paunds one beega, and 120 beegas one chawur. At present, however, there is the widest difference in the size of the beegah, the term no longer conveying any adequate notion of the extent of land contained in it. According to the above measurement it may be computed at about ⅞'s of an acre. ...

A survey must always be the groundwork of a proper ryotwar settlement. Without it, the ryots are in a manner abandoned to the discretion of the village and district officers, a discretion which we know is always abused[1].

Except for Satara the assessment based on these early surveys followed too closely the high rates exacted by the Marāthas, and gave little encouragement to the extension of cultivation. In 1826, as a result of Chaplin's efforts, Robert Pringle[2] was appointed Superintendent of Survey and Assessment in the Deccan, and after his first reports was deputed in February 1827 to " the survey and assessment of the collectorates of Poona and Ahmednuggur, including the districts comprised in the late collectorship of Sholapoor "[3].

Pringle followed a *Memorandum of Rules proposed for a Revenue Survey and Assessment of the Deccan*, 1826, based largely on Munro's rules for the Ceded Districts[4] [II, 182], from which the following extracts are taken ;

The most correct method of land surveying is with the cross (sunkoo), the use of which is soon learnt by native surveyors. ...

The Surveyor is to be furnished with a standard yard measure of wood, by which he will, every fourth day, compare the measuring chain, which, if found to be extended by use or by the links being broken, must be rectified as occasion may require. ...

The following are the points of inquiry to which the surveyor's attention is to be directed. To ascertain what lands, said to be enams, are recent unauthorised alienations, or what may be properly escheats to Government from failure of heirs, and what Government lands may be concealed and kept back from the accounts. All such concealed resources, being fully developed and included in the jummabundy [I, 135], will entitle the surveyor to one half of the first year's revenue that may accure from them, with a reservation...of one-fourth of that moiety...to the informers. ...

As the pay of the surveyor is to depend in some degree upon the quantity of work done, ... some of them, in the hope of gain, may perform the duty in a slovenly manner, by neglecting to take the measurement of the angles requisite to enable them to find the contents of fields. The examiners...will...correct these inaccuracies, and, on detection, the surveyor to whom the blame may attach will be liable to...punishment. ...

The surveyor appointed to measure particular villages must not be allowed, at his own discretion, to undertake the measurement of other villages in which he may think that the duty may be executed with less labour and more profit to himself. ... Any deviation from this rule will be punished by fine. ...

Surveyors are...forbidden to beat or confine the inhabitants on any account whatever.

Pringle had no European professional assistance, and, as his results did not stand up to rigorous investigation, a regular survey by Indian measurers under close European supervision was organized by George Wingate[5] in 1837.

SOUTH KONKAN

The statistical survey of the Southern Konkan made by Jervis [126–7], though of considerable value for revenue purposes, did not include the measurement of land other than for general topographical mapping. In a published account of the systems of revenue collection and land tenure, Jervis describes "the indigenous units of measure" ;

[1] Report on *Fiscal & Judicial system...in the Dekhan*, by Chaplin, 1824 (34, 180). [2] Robert Keith Pringle (1802–97) ; Bo CS. 1820–50. [3] Bo RC. vol. 28/1827 ; 3–2–27. [4] *Bo RS.* (833). [5] Sir George Wingate (1812–79) ; Bo Engrs. ; KCSI.

The extent of land was estimated first by the oxen, or ploughs necessary to plough it; then by the quantity of seed requisite to sow it, then by the estimate of its contents; lastly by actual rude measurement with a rope, or eventually by the more correct rod surveys[1].

In February 1826 William Dowell was deputed to make a revenue survey under the collector of Ratnāgiri[2];

The object of this survey was to measure, classify, and assess, the lands of the taluka, using the ancient measures of land, classes of soil, and beghaonee rates of grain; to define boundaries of fields and villages, and record the names of the proprietors, tenants, etc., and to settle boundary disputes when practicable. Ancient customs were to be respected, and no interference made with the rights of the people or the tenures under which their lands were held. A census of the population was likewise taken.

The survey was completed in the month of May 1829, since which period Captain Dowell has been engaged in arranging the materials collected by him, and in preparing various papers. ... Latterly he has devoted his attention to the preparation of tables adjusting the amount...due to Government...by each individual. ...

Though the information collected...will...be very useful...as evidence of the resources of the taluka, ... it would be unsafe and impolitic to introduce the rates fixed by it in lieu of the present system by which part of the collection are received in kind, and part in money. ... No sufficient reason exists at present for disturbing a system of high antiquity, and one which the former Government supported, and to which we have adhered.

The principle of this survey has been to consolidate all the different taxes paid by the people into one general assessment to be imposed direct on the land. This would apparently simplify the system; it would, however, raise rents in some cases, and reduce them in others, and such attempts at equalization are always unpopular. ...

Captain Dowell, ... when not occupied by his own particular duties, ... has cheerfully assisted the Collector in various ways connected with the management of the district, with all the details of which he is intimately conversant. He was lately deputed into the talookas to inspect the crops, and the full information which he has collected...has been of great value... in ascertaining the merits of the claims to remissions. ...

As...great care should be taken of the valuable documents deposited in the cutcherry relative to the survey, I have placed on the new establishment proposed for this district... two of the carcoons [393] that have served under Captain Dowell, who recommends them on account of their intelligence and experience[3].

APPRECIATIONS

In 1836 a later Collector of Ratnagiri found Dowell's survey "of no public utility; no reference has ever been made to the papers", neither was the work of the revenue surveyors in Gujārāt appreciated by district officers in general [171]. The following comments were made by the Principal Collector of Ahmadābād;

The chief benefit derived from the survey records consists in the information...of the extent and capability of the soil, the population, wells, and state of cultivation in each village at the time of the survey. ...

I am not aware of any great assistance being afforded by the survey in making the assessments, there being only two modes of assessments in this zillah, the begotee, and bhagdarey; the rates of these two are permanently fixed, and do not fluctuate yearly.

With regard to...the right to exemption from revenue on lands held by individuals, no information is to be gained from the survey. There is...a register...of such lands, but no investigation or scrutiny was made by the survey officers...to determine whether the claims to exemption were well founded. ... No information...collected by the survey on points interfering with individual rights could be admitted as evidence in any Court of Justice[4].

The Judicial department held similar views;

Both the Judge and Collector of Ahmedabad report that the survey has not furnished any facility in...judicial business, nor do they consider it adapted for such a purpose. A former Judge...thinks differently, for, while...it was of no use at...Surat, he remarked that in his time at Ahmedabad he derived great assistance from its records in land and boundary suits.

The Judge and Collector at Surat concur in representing the survey as having been nearly

[1] *Bo Geo Soc.*, May 1840 (68–9). [2] Bo GO. 13–2–26. [3] from Rev. Comnr. 4–1–33; Bo RC. camp, 517/1833 (1–5). [4] Bo RC., camp 370/1831 (15–8), 1–10–31.

useless for judicial purposes ; the latter think it may, however, have prevented litigation by bringing subjects of dispute to a fair issue. ...

The sub-collector at Baroache appears to have made a great deal of use of the survey records in disputes concerning alienated lands, to no purpose, since he describes his references to them as only determining the settlements made by the survey, not as furnishing grounds for determining their correctness.

The Judge and Collector at Poona report that the survey has hitherto furnished no judicial information. ... The grounds on which its settlements are made cannot be depended on as authentic, and the native revenue officers seem to be actuated by a similar opinion. ...

The remaining zillas of Ahmednaggur, Konkuns and Dharwar, have not been surveyed to a sufficient extent to furnish materials for conclusions ; ... the authorities at these places, however, all concur in representing the survey as totally useless for judicial purposes. ...

The Judges of the Sudur Dewanee Udalat think that such an undertaking must always be unavailing to a court of law from the radical defect arising from the want of an antagonist interested in the same manner as a party would be who prosecuted or defended a claim in court. The survey officers could never depend on having heard both sides of a question, because their enquiries are not made on the particular occasions when the parties concerned have any reason for desiring investigation ; nor indeed could those officers ascertain whether the parties concerned had been really consulted at all[1].

It is obvious that the great mistake of all these early revenue surveys was asking anything more from the surveyors than their professional work of making accurate measurements of the land. Classification of soils, and determination of boundaries are matters for civil administrative officers.

[1] Sudur Dewanee Udalat, 30–11–31 ; Bo RC., camp, 370/1831 (21–5).

CHAPTER XIII

ASTRONOMICAL CONTROL

Himālaya Districts, 1816–22 — Bengal Surveys, 1816–23 — Burma War ; North-East Frontier & Arakan, 1825–7 — Burma, 1825–8 ; — Bengal, 1823–30 ; Proposed Astronomical Survey — Surveyor General's Observatory — Field Surveys ; — Madras — Colaba Observatory.

BENGAL surveyors were still dependent on astronomical observations for geographical position, though left as a rule to provide their own instruments. Many of them acquired a high degree of skill, more particularly Hodgson, Webb, Gerard, and Grant, and with the improvement of instruments and astronomical tables[1] Reuben Burrow's values of 1887–9 were gradually superseded [I, 163–4].

The work of Hodgson and Herbert in the mountains forms a story of its own, because the high hopes that were set on its accuracy were frustrated by abnormal deflections of the plumbline that were entirely unsuspected [34, 45]. Hodgson had made frequent astronomical fixings in the upper *doāb* and on the Nepāl frontier between 1813 and 1815, and when he started his survey of Garhwāl and Sirmūr in 1816 he sought to base his triangulation on the difference of observed latitudes, rather than on chain measurement across rough and broken ground [30].

It appeared to him that the great superiority of modern instruments, allowing of considerable accuracy in the determination of latitude, afforded means almost as unexceptionable, for geographical purposes, as the measurement of a base-line. He thought that, by choosing two stations sufficiently distant, and determining carefully...the latitudes, ... their distance might be found sufficiently near the truth from the known value of the degree of latitude. ... From this line considered as a base, he intended determining others by means of a triangulation, which was finally to take in the limits of the snowy chain[2].

The first station was at Belleville, Sahāranpur [38 n.7],

the house of Mr. Grindall[3], the judge and magistrate, ... —a large and conspicuous white building in an open situation. The second, or northern, station is a very remarkable and lofty mountain called the Chur [II, pl. 10 ; III, 30 ; pl. 5], ... upwards of 11,000 feet above...Seharanpur. ... The station mark on the Chur is a pyramid...of pine trees, rock, and turf, 35 feet high, ... visible from Belville with the instruments I intended using. ...

The distance of these stations is upwards of 61 miles, ... sufficiently long to serve as a base for the most distant snowy peaks visible, ... and I hoped that, by taking a great number of zenith distances at each place, I should be able, with a reflecting circle, to determine the difference of latitude within 2 or 3 seconds, which, relatively to the great length of the arc (upwards of 53 minutes), could only occasion a small uncertainty in the distance[4].

He made repeated observations for latitude on Singora and Chaur peaks between February and April 1816, and after an exploratory tour through Sabāthu, Simla, and the Sutlej valley, returned to repeat his observations on the Chaur in stormy weather in October [31–2]. Making a tour through the plains during the cold weather and meeting with Webb [32, 46], he returned in the spring to visit the sources of the Jumna and Ganges. He supplemented his triangles by frequent rays to snow peaks and astronomical fixings, observing Jupiter's satellites,

not with a view to correct the survey by the differences of longitude they give, as I can know the difference more correctly by other means, but to try how the differences...are to be

[1] but the Greenwich Tables for 1821 had nearly 300 errors, *As J.* XIX (162, 685). [2] Herbert's Journal, DDn. 168 ; M 366. [3] Rivers Francis Grindall (1786–1831) ; BCS. 1802 ; m., Sahāranpur, 16–8–16, Jane Munn : magte. Sahāranpur from Jan. 1816 ; Belville shown on map, MRIO. 10 (18) [vol. II, pl. 10]. [4] Hodgson ; *As R.* XIV, 1822 (187).

depended on when, for want of more certain data, I may be obliged to call in their assistance.

He was not happy about his latitudes, for

several of the meridian altitudes of the sun & stars gave results differing from the mean far more than I could wish, & much more than they do in the plains, but the inconveniences of observing on these stormy peaks is great, & induces discrepancies, & it is not impossible that refraction is variable[1].

He was joined by Herbert in May 1817 [33] and after spending the rains at Sahāranpur, they resumed observations in October, Hodgson at Sahāranpur, and Herbert at the Chaur. The longitudes agreed well, and were confirmed by corresponding observations of Jupiter's satellites from the Madras Observatory [177, 187]. I am glad to find that they are satisfactory. I have...eclipses taken at Seharanpoor, which...will further assist in fixing that important station and first meridian, from which I will calculate the differences of longitude of all the snow peaks observed from it and Choor station[2].

Herbert's latitudes were disappointing ; " for nice purposes ", writes Hodgson, " a sextant is of little or no use ".

His instrument was a sextant, & though he is an expert observer...the mean of his latitudes is 6″ different from the results by the circle. ... [He] has now the same circle which I had, & I have another ; one or both of us will shortly visit the Choor & determine his latitude definitely. The three angles of the great triangle, Saharanpour—Chour—Bhairaut will be observed[3].

Herbert took the latitude at the third great station, Barat[4], during April, and after further attempts Hodgson had to confess that

the hopes...of obtaining some very accurate and close results for latitude with the large circle were quite disappointed, and to what cause the very *strange discrepancies*...be owing...I am at a loss to determine. The adjustments were so perfect that it was impossible anything could be better. The only possible cause to which they can be attributed is the fault of the observer, yet I took every pains. On finding I could do nothing with this instrument, I again resorted to the reflecting circle. ... The observations taken...[were] tolerably good, and more consistent with each other than any equal number of observations I have yet made.

Mean result is 16 pairs of stars on opposite faces & opposite sides of the zenith ; the extreme differences 15″·7, and the greatest difference from the mean 8″·4. ... Latitude of the Chour 30° 50′ 17″·84, the result of 38 sets of observations on both sides of the zenith[5].

In his final review Hodgson admits failure,

though I had much larger and more perfect instruments than have hitherto been used in the mountains, or in any survey on this side of India ; and both of us had much practice as observers. When I had less experience, I was more confident as to the accuracy which...might be obtained from celestial observations, but now, far from being satisfied with surprisingly close results, I...consider them the effects of chance.

It has been said...that when experienced observers, after taking all the...precautions in their power, find themselves embarrassed by discrepancies for which they cannot account, they are on the point of making some important discovery ; at any rate, though they may not be so fortunate, they may, by making a fair disclosure, enable others...to do so [t-page].

The mean of Lieut. Herbert's observations and mine varied at the Chor only 4″, which is less than could be expected. ... To prove whether the difference of latitude of our large arc, Belville and the Chur, was certainly determined, I established a third...station on the fort of Bairat, the three places making a well-proportioned triangle. ... There, a great number of observations were made by Lieut. Herbert and myself at different times, ... with the same reflecting circle, but the mean of our observations differed 7 seconds.

At all the three stations, the angles and azimuths were carefully observed, yet we had the mortification to find that the latitude of Bairat, as deduced by strict calculation on the latitude and azimuth arc, did not agree with the mean latitude actually observed...as it ought to have done, but differed from it ten seconds. Had it differed only three or four seconds, we should have been content. ...

Much chagrined at the disagreement, we were at a loss what steps to take ; whether to consider the latitude of Belville as satisfactorily settled, and that of the other two stations as erroneous, or to divide the error equally between the three. Still suspecting that some oversight had taken place, though none seemed palpable, we determined to try a second proof station ; ... the mountain of Surkunda[6] was fixed on. ... There, latitudes, angles, and

[1] Journal ; MRIO. M 360 ; 11–3–17 ; 27–3–17. [2] to SG., DDn. 157 (17), Feb. 1818. [3] Journal, MRIO. M 380, Jan. 1818. [4] 7,406 ft., ½ m. N. of Barat Khai pass, 53 F/14. [5] Journal ; MRIO. M 362 ; June 1818; True value, astr. 30° 50′ 13″·9 ; trig. 30° 50′ 49″·9. [6] 9,075 ft. ; 16 m. E. of Mussoorie [37].

azimuths were observed, and again the observed and computed latitudes differed to the amount of some seconds, ... the computed arc proving greater than the observed. Observations on the Wartu mountain gave differences in a contrary sense.

Thus perplexed, we despaired of arriving at the accuracy we aimed at, ... and resolved, cost what time it might, to try and clear the difficulty by measuring a base[1].

Mackenzie had the observations sent down to Madras for check ;

A completion of their surveys of that interesting tract is an object of some interest, for...the eyes of scientific men are turned to the Thibet mountains by late publications [46]. ... Captain Hodgson's...sickness has in fact permitted little to be done these 14 months, at least in details of a geodesical nature. Several positions have been observed, ... and...the observations for one place repeated beyond all common necessity ; no doubt they will be accurate.

Those of...the former year were...sent to the observatory at Madras for...being checked by corresponding observations, and [were] returned with satisfactory notices by Mr. Goldingham. This method, which had been practised by the late Colonel Colebrooke, Dr. Hunter, etc. [II, 190–1], I would still recommend[2].

Hodgson's health became so bad that he withdrew from the survey, and left Herbert to carry on alone [35]. His observations at Sūrkanda confirmed Herbert in his decision that a distance derived from astronomical observations of latitude could provide no satisfactory foundation for the survey. Working "with different instruments and at two different periods", he and Hodgson could not get away from a discrepancy of ten seconds in each of their great triangles. The only thing to do now was to measure a base on the ground [37][3].

It is strange that Hodgson, with all his studious reading, had no suspicion, even so late as 1820, of the possible effect of local attraction, a subject that was familiar to both Lambton [II, 194, 261] and Everest [44] and it was indeed unfortunate that he should have tried this experiment in a region where the most extraordinary anomalies prevail.

The irregular and abnormal deflections in this region brought to light by the Great Trigonometrical Survey were discussed at length by Sir Sidney Burrard in 1901 and investigated in the closest detail[4]. The main facts that defeated Hodgson are that whilst there is a northerly deflection of the plumbline of 15″ at Sahāranpur, this is no less than 36″ at the Chaur and 39″ at Bharat. Such discordances give errors up to a third of a mile in computed horizontal distance, and rendered all Hodgson's care and labour of no avail whatever [35–7].

Herbert measured his base-line in the Dūn early in 1819, and adjusted the whole triangulation to it. Geographical position was determined from the observed latitude and longitude of Sahāranpur and the azimuth of the Chaur;

The basis of all these results is the latitude of Belleville, taken at 29° 57′ 10″, ... by a mean of upwards of 100 observations[5]. ... The observations of longitude...consist of 25 emersions of Jupiter's first satellite. ... The results are all referred to the meridian of the Choor, the mean longitude of which comes out 77° 28′ 39″[6] [pl. 5].

Webb also based his survey of Kumaun on astronomical latitudes, though he realized that these were not entirely satisfactory, and the accuracy of his survey was condemned by Everest on this account [44–5]. For longitude he adopted

that of Peleebheet by Mr. R. Burrow, though I am fully aware that the accuracy of that position is very doubtful [I, 160–3]. I ought to have preserved the whole of his positions, but, before I was aware of the consequence, I had inserted Kasheepoor from my own computation, which does not give the same difference of longitude between that place and Peleebheet as Mr. Burrow's observation. ... Any part, or the whole, of this sketch may be transferred to your map by simply correcting the longitude of Peleebheet and every other meridian[7].

Distrusting the accuracy of chain and perambulator measurements in the hills, Hodgson devised a method of surveying the major rivers by means of chronometers and observations for time ;

[1] *As R.* XIV, 1822 (188). [2] DDn. 154 (21), 12–9–18. [3] Journal ; DDn. 137, M 322, 30–10–18. [4] *Prof Paper* 5. [5] true value : Astr. 29° 57′ 09″·5 ; Trig. 29° 57′ 24″·5. [6] True value 77° 28′ 50″. [7] to SG. 4–3–19, DDn. 150 (95).

In a mountainous country we must...depend on chronometers for the difference of longitude by...transferring time when the courses happen to be (as for the upper parts of the great rivers within the Himalaya) not far from east and west. In the deep beds of those rivers all ordinary means...fail when the latitudes are nearly the same, and the windings...among precipices and defiles is so great. ... In certain situations we can avail ourselves of the assistance of the great snowy peaks to fix our position, and, when we cannot, we must trust altogether to latitudes and transference of time by the means of several chronometers[1].

He published in *Asiatic Researches* a long list of the latitudes and longitudes he had fixed, not only during his survey in the hills, but also on various surveys in the *doāb* and elsewhere, and on his river journeys to and from Calcutta[2] [II, 193–4].

BENGAL SURVEYS, 1816–23

The great disadvantage of control by astronomical fixings was that each surveyor worked independently of his neighbour. Gerard, for instance, was surveying Sahāranpur and the Dūn for the Revenue Commissioners [22–3, 157], and taking observations all through 1817 without any co-operation with Hodgson [43]. By the means of 7 observations, all within 20″, he makes the latitude of Meerut 28° 59′ 12″, and from 30 observations of the sun he makes the latitude of Dehra 30° 19′ 2″[3]. He writes regarding his map of the Dūn [pl. 3] ;

Boudrajh, Byrath, Chandee and Nalapanee, being peaks one or more of which were almost always visible, I was very particular in ascertaining their positions. The latitude of Bhyrath was determined by 267, Bhudrajh by 229, Chandee by 59, and Nalapanee by 57 circum-meridian altitudes of the sun and stars, and, as the observations were north and south of the zenith, I think the above places can scarcely be 5 seconds wrong.

The latitudes of the places of encampment (with the exception of 9 which could not be observed by reason of clouds) were fixed from 5 to 10, and sometimes by 30 or 40, observations of the sun and stars. ...

I have every reason to believe that the differences of longitudes are as correct as the latitudes. Keara Sorone, and Sankoth are the only places where the difference of longitude was ascertained by chronometer. The rest were worked by trigonometry from the bearings of Bhyrath, Bhudrajh, Chandee and Nalapanee. ...

By observations of Jupiter's 1st and 2nd satellites the longitude of Bhudrajh comes out 78° 0′ 30″[4]. I have however not drawn the meridian lines, as I have got two occultations of stars by the moon and two solar eclipses which, when compared with the Greenwich observations will give the longitude more correct than Jupiter's satellites[5].

Peter Grant took his astronomy very seriously and read all the books he could find on the subject. The field books of his surveys of the lower *doāb* and Gorakhpur are full of long technical discussions [20–2] ;

The latitudes...were in most places deduced...from meridian altitudes. The instrument ...was a sextant made by Troughton of 15 inches radius, and of admirable construction. ... In the hot weather, ... when the thermometer ranges 95° in the shade, it is astonishing how rapidly the error increases and diminishes. I have observed the error of a sextant vary from 1′ to 6′ and 7′ in the course of 10 minutes, when exposed to the sun. ... Observations of stars are in every way preferable. ...

The longitudes are inferred from the meridian of Azimgurh, which is considered to be 83° 10′[6]. My large telescope did not reach me till the middle of September, long after the opposition of Jupiter, consequently I had few opportunities of observing the eclipses of Jupiter's satellites. ... There are also 18 lunar observation, of which 5 only have been calculated. The altitude of the sun and moon were observed alternately. ...

The latitude of Azimgurh was deduced from a mean of 55 observations, 12 of which were of stars only, and made with Gilbert's sextant. These gave a mean of 26° 3′ 15″. The remaining observations were made with Troughton's sextant, and consisted of meridian altitudes of the sun, altitudes of the pole star and of Fomalhaut, and equal altitudes of the sun. A mean of these gave 26° 3′ 24″. This is the latitude of the collector's Kutcherry. ... In Arrowsmith's map, ... and I believe in Rennell's maps, it is laid down 26° 6′[7].

[1] DDn. 152 (38), 1-3-18. [2] *As R.* XIV, 1822 (153–79). [3] Both values fall within present limits of the stations. [4] true value, 77° 57′ 29″·07. [5] DDn. 212 (15), 25-11-18. [6] true value 83° 12′. [7] ib. 26° 5′.

The longitude of Goruckpoor, according to Mr. Arrowsmith's map of 1820, is about 83° 7′. ... Captain Webb's survey [II, 34]...makes it 82° 18′, ... a difference of 50 minutes. ... Major Rennell made it 83° 45′. In Mr. Arrowsmith's map of 1804 it is 83° 22′. It may... be assumed to be 83° 16′[1]. ... This perhaps is not far from the truth, and it is hoped that a permanent residence in this district will afford the means of determining the point. ...

The latitude of the Residency at Lucknow deduced from the survey, which corresponds exactly with that from observation, is 26° 51′ 27″, and the longitude 80° 55′, but I have good reasons for doubting its accuracy. ...

There were several occultations of fixed stars observed, some of them not mentioned in the Nautical Almanac. I have not...just now the names of some of the stars, not having brought along with me my celestial globe, which I regret much, for I think it is among the most useful instruments that a surveyor can possess. ...

On the banks of the Toonse River. The course of this river has not been accurately laid down. ... Mr. Burrow, who remarks that his observations of latitude cannot err 5″, states the conflux of the Toonse with the Ganges to be in latitude 25° 16′ 16″ and longitude 82°. Arrowsmith makes its lat. 25° 42′, long. 84° 10′. It is difficult to account for so great a difference. Mr. Burrow was a good mathematician, and an excellent observer. His latitudes ought to be depended upon, but the same cannot be said of his longitudes [24].

Grant was unduly exercised, and was gently corrected by Mackenzie :

If you extend your inspection to Arrowsmith's map, you will find Mr. Burrow's & Col. Colebrooke's position of the Toonse correctly laid down as a river running from Bundelcund into the Ganges somewhat below Allahabad. Your Tonse is quite a different river[2].

As the survey progressed, Grant was able to improve on his results

by using the French tables contained in the works of Puissant Biot, etc. [183][3], and also by using an 18-inch astronomical circle. A second edition of the map will therefore partake of these improvements. ... My approaching journey to Furruckabad via Cawnpoor, etc., will enable me to devote the astronomical circle to the useful purposes of geography.

In his survey of the Sundarbans, Hugh Morrieson derived his longitudes by chronometer and observations for time. He was troubled by humidity and

never succeeded in getting an observation of Jupiter's satellites, although repeatedly attempted. The dew falls so very quick that the object glass of the telescope is constantly covered with the wet, and in wiping off this the motion communicated to the instrument has...rendered the observations very doubtful. The chronometers...have given the longitude [of Jessore] 56½ and 57 miles east of Calcutta, and this agrees pretty well with the survey[4].

On his journey up the Ganges in November 1815 Hodgson suggested that

chronometrical measures may also be compared...by differences of longitude taken by the firing of gunpowder. The flash of half a pound of gunpowder fired at the hill house at *Pir Pahar* near Monghir would be seen at *Janghira* rock, from which a flash would be seen at *Patter Ghatta*, below *Bhagalpur*, and thence at *Pir Painti* ; or *Sicri Galli*, or probably *Rajmal*[5].

He never appears to have tried this himself though he urged other surveyors to do so [90, 182–3]. On this journey he took a continuous series of barometrical observations for height [204], as well as latitude and occasional longitude observations, and compared his positions with Rennell's *Bengal Atlas*, Arrowsmith's map, and Burrow's observations. He records at Allahābād ;

Noon. At the bathing place, confluence of the Ganges and Jumna. The barometrical observation uncertain by reason of the motion of the pinnace, forcibly dragged through strong water. I had not an opportunity of taking latitude on account of the crowd of bathers, but R. Burrow's for the S.E. angle of the fort is 25° 25′ 56″ ; the Atlas gives 25° 27′, difference 1′ 04″[6].

On his Chittagong survey Cheape found that his longitudes from Jupiter's satellites "agree so ill with each other" that he preferred to accept Rennell's value for Islāmābād [I, 152] and trust his own ground measurements ;

The correctness of the longitude...in no way affects the correctness of the map...in itself, and by survey the longitudes of all the places therein are much more accurately laid down with relation to Islamabad than they could have been by any astronomical observations[7].

[1] true value 83° 22′. [2] joining Ganges from N. at Ballia 150 m. lower down, DDn. 154 (43) 26–11–18. [3] "MM. Biot et Aragot, membres de l'Académie des Sciences, Astronomes adjoints du Bureau des Longitudes", measured arc of meridian in Europe, 1805–6 ; *RAS.* (*mn*) XIV (102–7); to SG. 12–3–21 ; DDn. 147 (180). [4] DDn. 147 (152), 31–8–18. [5] direct distance Monghyr to Sakrigali about 80 miles ; cf. Lambton's method with blue lights [II, 259]. *As R.* XIV, (189). [6] Journal, MRIO. M 473 (113). [7] Cheape, 14–10–19 ; Fdbk. M 257 ; report attached to MRIO. Misc. 6–O–20.

When he became Surveyor General Hodgson did as much as he could to stimulate precise and methodical observations. He issued elaborate technical instructions for surveys on the western frontiers[1] [89, 201], and took particular interest in the survey of Bhopāl [87–8] for which Johnstone had submitted

a list of places, the latitude...determined by a mean of two and three observations of the altitude of the star *Formalhaut.* I regret much my telescope and chronometer have not yet arrived, as I should have had in this excursion an opportunity of fixing the longitude...along the eastern banks of the Chumbal [pls. 1, 9]. ... I find that a determination of the latitude at intervals of 25 and 30 miles is most suitable, ... and have confined my observations during the past month to places of note only[2].

Hodgson thought this insufficient ;

The dawk has brought your list of latitudes consisting of 48 observations...of 29 places in 5 months. On every marching day there ought to have been at least two stars, north and south, taken on both arcs of the circle, which has not been done. ... No corrections are made to the refraction for the state of the barometer and thermometer, nor is the sun once observed, though it might have been taken almost daily. ...

Your observations for latitude...run rather wide ; a sextant by such a nameless maker as Bate is not a good machine to use. I never use sextants except to take equal altitudes for the time of noon. Reflecting circles of Troughton's construction are the best. ... As to the index error, you had better not meddle with that ; let it remain, but always record it. ...

It is of little use observing stars of nearly the *same altitude* on the *same side of the zenith,* and it is not good to observe low stars, and very high ones cannot be observed with the instrument. ... The 24 stars which you will find in the Nautical Almanac are the best ; pay due attention to the focus of your telescope, ... but if the telescope of your sextant is a bad one, I advise you to diminish the aperture of the object glass by putting on a cap of paper, or pasteboard, which will diminish the blur of a large star. ...

Troughton's sextants are...sold here for about 250 or 300 rupees each, and, if you wish it, I will purchase one for you. Your sextant by Bate is divided to 10 seconds [217] ; it is of no consequence to what instruments are divided, if their construction is not correct[3].

For Gerard's survey through Mālwa [89–90], Hodgson recommended a framework of long traverse lines running north and south—and east and west—controlled by reliable astronomical fixings ;

Agra, Gwalior, Nurwar, Seronge, and Bopaul are nearly on the same meridian, and the measurements...can be checked by observations of latitude, and it is the same with Augein, ... Kotar, and Tonk. ... On the east and west lines the differences of longitude between Bopaul and Augein, and between Jeypour and Agra, will be corrected by chronometers [pls. 1, 9, 24].

I will by no means be satisfied with the relative positions assigned to the last mentioned places, and several others in the eastern parts of Malwa in the latest map of that province [84], because they are for the most part laid down from route surveys hastily made in the time of war, and under disadvantageous circumstances, and seldom correeted by exact astronomical observations. ... It is highly desirable that their positions with relation to Agra, and with each other, be determined as well as possible[4].

Gerard discusses his results in considerable detail, especially as regards their probable error, and made several corrections to Malcolm's map.

It very frequently happens that the disagreement amongst surveyors with regard to latitudes is not occasioned by any inaccuracy in the observations, but...from a want of particularising the exact places at which the latitudes were taken. ... I have often heard disputes about latitudes, especially those of an extensive cantonment or large town. ... On the route, the extreme difference of latitude by any two observations taken at the same place exceeds 8″ at two stations only, so 5″ may be reckoned the probable error in latitude, when there is only one pair of observations[5].

He closed by observation for latitude at the Tāj Mahal, taking "star places from Nautical Almanac of 1823 and Pond's[6] catalogue of 1817, and refraction taken from the new table in the Nautical Almanac"[7].

In sending him out again at the end of 1826, Hodgson commissioned Gerard to determine the difference of longitude between Fatehgarh and Agra before working further west, but his health broke down before the task was completed [90].

[1] DDn. 154 (196), 21-11-21. [2] DDn. 212 (131-3), 2-11 & 2-12-20. [3] DDn. 198 (60), 12-6-23. [4] ib. (93) 18-6-22. [5] Fdbk. MRIO. M 313 ; closes, Agra, 22-12-23. [6] John Pond (1767–1836), AR., 1811–35 ; FRS. [7] Journals, MRIO. M 311, 313, each contain over 300 pages of astr. obsns.

Astronomical observations were by no means neglected by all who contributed to Malcolm's map, as Hodgson implies, and Dangerfield [pl. 9] reports that

latitude observations from three or four observations of the sun, or...to a pair of N. and S. stars, ... agreed amongst themselves to within ten seconds. ... —Instruments, either a reflecting circle by Troughton or an excellent brass sextant of ten inches diameter—North Polar Distances, with annual variation from the new list in Nautical Almanac—necessary corrections applied for temperature and barometer when calculating refraction. ...

The loss of my achromatic refractor prevented observations of...Jupiter's satellites. The longitudes...are, therefore, derived from differences...of time, combined with the land survey and observed latitudes, taking Oojein at 75° 58′ East longitude[1], according to Dr. Hunter's determination [I, 56–7, 168]. The difference of time was acquired by means of two excellent chronometers...and by observations of equal altitudes. ... I thought also to secure greater accuracy by marching as rapidly as possible the direct E. and W. distances. ...

I deemed it necessary to be thus minute...from many of my positions differing essentially from those of the latest and best printed maps.

The greatest errors appear in the north part of Malwa, and that part of Mewar termed, from its capital, Oodeypoor, a tract till very lately little explored by Europeans. The city of Odeypoor itself is placed nearly half a degree too far north, and a like distance too much to the eastward; thus bringing it nearly N.W., instead of almost S.W. from Chittore, which last, excepting being a little too much south, is sufficiently well placed. ...

The variation of the magnetic needle I have found, by an excellent transit instrument, to be at Mhow about 4° 30′ W. In other parts...from that to 3° 30′ west.

He appended a list of about seventy places, with their latitudes, longitudes, and heights above sea-level[2].

BURMA WAR; NORTH-EAST FRONTIER & ARAKAN, 1825–7

The revenue surveyors called to military duty for the Burmese war [52–3, 65] had been serving under Hodgson, who expected them all to be practised astronomers, a qualification of particular value, since the north-east frontier was practically unexplored except for Wood's survey up the Assam valley [I, 80–2; III, 52]. In his general instructions [53 n.1, 198–9] Schalch particularly noted that

the geographical situations of the towns marked in the accompanying lithographical map are so vaguely laid down that you must not look to them as fixed points. ... On the contrary, their geographical positions must be correctly ascertained; ... you should have recourse to astronomical observations for...latitude and longitude. ... Forms of calculations and necessary tables supplied. ... The instruments you will require are a sextant, false horizon, chronometer, and a telescope. ... Mode of use explained in treatise supplied[3].

Hodgson kept in touch with them all;

I was at that time the Revenue Surveyor General. With these officers, though they were withdrawn from my superintendence, I continued to keep private correspondence, and I particularly requested them to make as many observations of the satellites as they could, that I might compare them with those I made at Futtehghur [189]; and to the skill and zeal of Majors Bedford and Wilcox in Assam, to Major Pemberton in Manipur, of Major Fisher in Sylhet, Captain Wroughton in Arracan, and the late Captain Grant at Prome (all officers of the Bengal N.I. Regiments), I am indebted for many data by which the geography of the eastern frontiers has been so much improved.

When places like Suddia, Munnipour, and others at such great distances, ... can have their positions assigned to them, exactly in latitude, and within perhaps 2 or 3 miles...[of longitude] by a few correspondent observations of the satellites, they serve as starting points from which to originate more detailed and local surveys[4].

Wroughton describes the astronomical work done in Arakan where the campaign was by far the most arduous, and the whole force soon saturated with fever [68–70].

I have sent you all the...observations taken by Thomson, Crommelin, Captain Crawford, and self. ... I am sorry to say that not one single observation for the longitude was ever made. ... The fact was, the movements of the army were at times so rapid as to preclude the

[1] true value, 75° 47′. [2] Malcolm, II, appx. ii (316–7, 348–9). [3] DDn. 214, 20-12-24. [4] *JASB*. IX, 1840 (81–2).

possibility of any good sights being made. ... Poor Major Schalch, who alone posessed a transit instrument and capital telescope, undertook to establish the longitude of all places where an opportunity admitted, while Crommelin and self were employed...incessantly upon the more arduous duties of surveying and reconnoitring [68–9].

Thus the instruments, which would alone admit of any correct longitudinal observations, ... were altogether under the charge and management of poor Schalch. ... His property, partly left behind, and partly under the charge of Commodore Hayes, was left in a state of the greatest confusion, so that whatever documents appertained to him at the time of his death remained with Commodore Hayes and Captain Crawford of the Research [17, 68, 70].

When we reached Arracan[1]...our chronometers had been much disarranged from...having them much moved about, and occasionally allowed to run down. This...prevented any good observations for longitude being made ; ... and what was worse than all, not one of us could set up the transit instrument, the directions to do so happening to have been mislaid...among poor Major Schalch's papers. The latitudes...are, however, very correctly ascertained and... may be fully depended upon[2].

Bedford, from the Assam valley [53–5], reports trouble with faulty chronometers, want of a false horizon, and something wrong with Wilcox's sextant :

Since arrival at Rungpoor I have made very frequent observations. ... The uncertain rate of my chronometers has caused me much...annoyance. ... This uncertainty, combined with the frequent clouds and rain which attended me up the river, and the probability that various minor surveys would rest upon my own as a base, appeared to render regular operations very desirable. I succeeded in effecting a regular survey from Bishenath as far as the Now Dihing Mookh and, although I...doubt the observations for latitude made at the latter place, it was still satisfactory to find that the difference of latitude...at the two extremes of the survey did not greatly differ from those shewn by the map[3].

On Bedford's withdrawal at the close of military operations, Wilcox was left with a special mission to trace the source of the Brahmaputra [55–64]. To Hodgson's suggestion that he should make a downstream journey from Sadiya to Goalpara to find the difference of longitude by chronometer, he replies :

Had I a chronometer of settled rate, it would...be desirable to take advantage...of the increased velocity of the current, and...in one long stride, in two, or in shorter steps, to gain ...an approximate difference of longitude. But the one I have (Mr. Scott's property), though made by Margetts and of the larger size, has varied so much—...from 60″ or more losing—to a gaining rate—that I should not set about my task with any confidence.

The unsettled weather...will diminish the few opportunities left us, by Jupiter's near approach to the sun, of observing eclipses ; and were I to drop down for this purpose, I might have to start on the long voyage from Goalpara at the opening of the favorable season for operations here ; for the navigation upwards is, in the intermediate time, either altogether obstructed, or dangerous and dreadfully tedious[4].

Hodgson suggested that, by taking two or three chronometers by boat down a rapid stream a degree a day or so, we might have the difference more exactly than by any methods, except triangulation on a great scale, or the flashing of gunpowder or other bright lights exhibited or suddenly extinguished ; but...great care, very good apparatus, and experienced observers are required at both ends [III, 179, 183, 189]. ...

Had I leisure and opportunity, I should like to run longitude down rivers with 3 chronometers ; 2 are always required, and a 3rd for umpire is good. Our affair is to get first meridian in Assam...and to make as good differences as we can therefrom. The satellites and transits are the means to be used for the first meridian, say Suddiya, but...many observations are requisite, and care, very great care, ... in making them[5].

Wilcox had trouble with the large Troughton's sextant on account of some imperfection in the instrument. I was induced...to give a full trial to an inferior reflecting circle by Gilbert...to obtain the latitude of my starting point, but the results were as unsatisfactory as...before. [13 values by the reflecting circle at Goalpara differed 2′ 11″ between highest and lowest]. The sextant gives excellent differences of latitude, & must at all events have been used in preference to this inferior circle ; an unlucky accident, however, ... deprived me of the use of it[6].

Pemberton took longitude observations at Manipur ;

[1] Myohaung [68]. [2] to SG., 29–4–27 ; DDn. 225 (111–6). [3] to SG., DDn. 214, 11–10–25. [4] DDn. 224, 18–6–27. [5] DDn. 220 (253), 20–8–27. [6] DLR. M 456, 1828.

Five observations of the emersions of Jupiter's 1st satellite have been made in the past month, the first and last of which are more wide of the mean than I could have wished, ... but I do not feel myself justified in rejecting them until a sufficient number shall have been obtained. ... The mean...[at] the capital of Munipoor gives its longitude 6h 16m 25·94s, East of Greenwich. ... Could you favour me with comparative observations made in Calcutta, it is probable the results would be still more satisfactory[1].

After the close of the war [51–2] Fisher sent in a fieldbook from Sylhet, containing chiefly astronomical observations for the longitude of this station and that of Budderpoor, which last I settled by transference of time. I was disappointed in...the flashing operation with Pemberton, as he...could not perform his part of the business, but I took the true azimuth of these points, from which...he may possibly have an opportunity of making the signals, which...is the more desirable as our several determinations of Sylhet and Munnipoor, when referred to each other by the measurement, disagree by about 30 seconds of time[2].

He was told to persist with Jupiter's satellites and to try lunar transits.

Hodgson describes two earthquakes felt at Calcutta during 1828 ;

19th Sept. I daresay you felt the earthquake on Thursday morning ; it was 15 minutes past 7 ; I never felt so smart a shock in the plains ; it was almost instantaneous to my feeling, and like the explosion of a mine underfoot, the direction east or south-east[3].

8th July. This morning about 2 minutes past 2...we were tossed a little by an earthquake. It continued...between 2 and 3 minutes, with a very unpleasant swinging motion, to the annoyance of the crows in the trees, which made a great noise in consequence of being disturbed. I think the most hideous noise I ever heard was made by some hundreds of peacocks under similar circumstances in a fakeer's tope, near which I was encamped.

If earthquakes could be felt all over the country, and the times marked at each place, we might get some idea whether the motion were progressive like waves, or proceeded from a center like the explosion of a mine[4].

BURMA, 1825–8

When Grant was ordered to Burma [71], he realised that triangulation would be impossible, and he took all his high class astronomical instruments [213], and a formidable library of scientific books ;

Venie's Astronomy, 3 vols. quarto.—Puissant's Géodesie, [294-5] 2 vols.—Callet's Logarithms[5], 1 vol.—Callet's Topographie, 1 vol.—Hutton's Topography, 1 vol.—Pearson's New Astronomical Tables, 1 vol.—Taylor's Logarithms, 1 vol.—Biot's Geodetical Observations, 1 vol.—De Lambre's Astronomie Physique, 3 vols.—Biot's Physical Astronomy, 3 vols.—Selections of Astronomical Tables, 1 vol.—besides other minor works[6].

He was already an experienced observer and had recently learnt much from personal intercourse with the Astronomer Royal at the Cape[7], ... more particularly by his new and admirable method of deducing the longitude from the transit of the moon and stars[8].

He had tested this new method and published his results in an article entitled "*On a New Method of Determining the Longitude from the Observed Interval between the Transit of the Moon's Enlightened Limb and that of the Sun, or of one or more stars*"[9]. These lunar methods eventually proved disappointing [191].

His first task in Burma was to obtain a reliable value for the position of Rangoon, where he arrived on 15th July 1825.

The observatory was erected on an eminence close to the pagoda called MacCreagh's Pagoda, 1153 yards S.E. of the great Shwe Dagon. ... The height...above the sea was calculated to be 172 feet, and the top of the spire of the Shwe Dagon pagoda as 536.

Respecting the latitude...there is more discrepancy than might be expected. That given by Mr. Wood [I, 84] is...16° 46′ 30″, but as he does not refer to any particular point we cannot compare his observations. ... Captain Ross, Marine Surveyor General [17], makes the latitude of the King's Wharf 15° 45′ 18″. Major Jackson [71] with a small Troughton's sextant makes it 16° 45′ 03″, but the differences between his observations vary considerably, some being as low as 44′ 21″, and some as high as 46′ 20″.

[1] or 94° 6′ 30″ ; true value of Imphal being 93° 57′; DDn. 204 (323), 3-5-27. [2] DLR., 45. 14-12-27. [3] to Fisher ; ib. 70. [4] to Montgomerie ; DDn. 231 (156). [5] *Tables portatives de logarithms* François Callet. pub. Paris, 1783. [6] Jean Baptiste Biot (1774–1862) [179 n.3]; DDn. 216 (1), 21-6-25. [7] Rev. Fearon Fallows (1789–1831) [187]. [8] DDn. 239, 1825. [9] *As. R.* XVI (235–60).

Grant worked out his mean latitude as 16° 47′ 27″ ·1, giving the Shwe Dagon as 16° 47′ 55″ ·6, compared with Ross's 16° 47′[1]. For longitude

the old charts give...about 96° 30′. ... In regard to Jupiter's satellites...observations cannot be considered as but an approximation. ...

I erected the transit instrument, to adopt the method followed by the Cape Astronomer. ... The instrument is, in its very nature, incapable of what is usually termed an instrumental error. ...It is, perhaps, the most perfect instrument ever invented for the measurement of celestial angles, for whatever error takes place after the requisite adjustments are made originates either with the observer himself or with the subordinate instruments he uses.

The results deduced from transits of the moon and stars are then affected chiefly by the errors introduced into the tables, ... but the data...have been of late so perfected by the English and French astronomers that the tables of the moon's longitude and latitude may be depended upon to 10″ of space at the utmost. ...

During...three months that I remained at Rangoon, I could only observe during 7 nights[2]. The result of the observations is finally given as 96° 13′ 27″ for the Shwe Dagon pagoda[3].

Having completed his observations at Rangoon by the close of the rains, Grant started up the Irrawaddy [71–2]

on the 12th October, intending to lay down the general course of the river from the magnetic bearings, and correcting the distances by astronomical observations. ... There are two methods of surveying the course of a river. One by triangulation. ... The second method is that of laying down the general course...from the compass, sketching in the features of the country from the eye, and determining one or two fixed points each day, from six to eight miles distance, by observing for the latitude and for the run in longitude by a good chronometer.

The second method was...the only way in which, at this season of the year, any attempts could be made. ... The slow progress of the boats afforded the opportunity of correcting the northing daily by the sun's meridian altitude, and that of the moon and stars at night, while the westing was corrected by the run of the chronometer. ... I made as many observations for the latitude and longitude as practicable, and all of them with a capital reflecting circle. ... The longitudes...from the chronometer were deduced from simple altitudes of the sun, the limb of the circle facing alternately east and west. ...

I reached Prome on the 28th, and on the following day had equal latitudes of the sun for the time, and meridian altitudes for the latitude, with the 12-inch reflecting circle[4].

He remained at Prome till February 1826, observing transits of the moon and stars for longitude. He reported in December that

during the last month I have been employed chiefly at the transit instrument. The greater number of observations have been made on the moon's first limb, the fogs during the night in general rendering the stars invisible. ... Mean of ninety observations, 6h 20m 42″7°[5]. The latitude from upwards of thirty observations is 18° 49′ 35″[6].

The Surveyor General, Blacker, was glad to get Grant's results ;

They will be of immediate use, but will be liable hereafter to definitive correction on a comparison with the corresponding observations which have been made here [188].

None of the catalogues of last century can be depended on, and those of the present century, I apprehend, are not in your possession [184]. I have lately received Piazzi's catalogue, and if you will send to me your list of observed stars, I shall be happy to return their ascensions and declinations as far as contained in that work. ... In the meanwhile I have the pleasure of sending to you a copy of Pond's catalogue of 400 stars, ... lithographed here. The copy has been three times examined, and I am well convinced contains no error of transcript[7] [260].

At the end of the war Grant moved to Moulmein [74–7] ;

On reaching Martaban, 27th April [1826], I obtained equal altitudes of the sun, giving longitude 97° 43′, the same as that given in a plan of the river drawn by Mr. Adam [74], and lithographed at the Surveyor General's office[8].

For his survey of the rivers also he used astronomical methods, but

the determination of the azimuths of distant objects was not easy. A perplexing hindrance arose from the thick smoke which pervades the atmosphere from the middle or end of December till the first fall of rain in April or May [21, 76][9]. After 10th of March, latitudes from observations of the sun are unattainable with instruments of reflection [200]. Regan and Sirius, the only

[1] true value, 16° 47′ 48″ : it is sad that Grant's work was not known to the surveyors responsible to the army in 1852–3. [2] owing to monsoon rain. [3] true value, 96° 9′ 8″. [4] Journal DDn. 239. [5] or 95° 10′ 40″ ; quoted, Pemberton (Tab. 19), and used by Henry Yule, 1853 : true value, 95° 13′. [6] correct. DDn. 216 (63), 4–12–25. [7] DDn. 220 (135), 3–1–26. [8] DDn. 239, M 241. [9] Triangulators were equally hindered 100 years later.

stars capable of being conveniently observed, ceased at nearly the same time to be visible on the meridian. Polaris was too low, and the fogs at night were in general so dense as to render stars of the second magnitude invisible[1].

BENGAL, 1823–30 ; PROPOSED ASTRONOMICAL SURVEY

One of Blacker's first interests after becoming Surveyor General was the possibility of a regular astronomical survey to cover areas beyond the reach of the Great Trigonometrical Survey. It was to be conducted by a competent astronomer of high qualifications, on similar lines to that of Reuben Burrow [I, 157–64].

Many ingenious operations have been conducted...for the correction by astronomical observation of detailed surveys ; but, as it is next to impossible their results should coincide with those of the Great Trigonometrical Survey, they will necessarily be superceded by the progress of the latter. I...recommend that all astronomical observations...shall be discontinued wherever the great triangulation is likely to fall, and that all disposable talents...be employed in following up its operations, for the completion of detail on indisputable grounds.

But for the flat country of Bengal, he recommended an astronomical survey with a departure from Fort William. I...propose that the surveys of the Sunderbunds and Burdwan be extended to the adjacent parts as soon as points of...departure shall be established. ... This...depends...on the employment of a competent astronomer, who shall successively adjust his instruments...at Madras, at the Surveyor General's office at Calcutta, and eventually at the stations of the Great Trigonometrical Survey.

He suggested John Warren as suitable [II, 449–53], on salary Rs. 800 a month[2], with headquarters at Calcutta for the rains, "where he will always have more than sufficient indoor employment at the Surveyor General's Office"[3].

Curiously enough a proposal was put forward by the Directors about the same time for a similar survey recommended by Rennell, who had been consulted as to the best way to get reliable material for an Atlas of India [I, 376–7][4].

We shall, in accordance with his recommendation[5], endeavour to procure the aid of a professed Astronomer, together with an assistant qualified to supply his place in case of accident, whose office it will be to fix astronomically such...positions as may be required...in the tracts remaining to be surveyed. ...

The operations...might be confined to tracts...to which the triangles of Lieutenant Colonel Lambton have not extended, and are not likely to extend. ... The positions...might be connected...eventually...to the purpose of the general map which we are desirous to obtain[6].

Stressing the speed with which an astronomical survey could be carried out, Rennell assumed that "all idea...of a series of triangles over the country is out of the question", an assumption firmly rejected Blacker, who pronounced his unhesitating support of the trigonometrical survey as the master control [2, 240–1] ;

If, on the other hand, the celestial observer be confined to those tracts whose nature forbids the approach of the Great Trigonometrical Survey, much advantage may be derived from his labours. This benefit, however, must depend on a different principle...from that to be inferred from Major Rennell's memorandum. No astronomical result is of value unless it be more accurate than that which it proposes to correct. ...

The memorandum estimates at 2½ to 3 years the period...for the astronomer merely to travel over his ground ; but no estimate is made of the time...for making observations. This omission is...to be regretted, as on the number of observations, as well as on the skill of the observer and the excellence of his instruments, depends the value of the results[7].

Pursuing the idea of a local astronomical survey, Blacker proposed "Lieutenant Grant...as the best qualified individual. ... The lower parts of Bengal, extending towards Chittagong, would be the first theatre of operations"[8]. Grant was, however, required for Burma [71, 183], and with Blacker's death the proposition was dropped until in 1827 the Directors asked for Hodgson's views regarding

Colonel Blacker's propositions for employing Mr. Warren, whose abilities as an astronomer and surveyor have frequently been brought to our notice by the Madras Government. ...

[1] DDn. 240, M 420. [2] Warren was now 54 years of age, comfortably settled at Pondicherry. [3] DDn. 204 (9), 26–12–23. [4] There may have been personal discussion when Blacker was in England. [5] dated 28–2–23 ; DDn. 90 (31). [6] CD to B. 29–10–23 (51–3). [7] Blacker to Govt. 11–8–24 ; *PR.* (25). [8] DDn. 204 (161), 1–6–25.

As there are regularly appointed observatories at Madras and Bombay [191–2], your Presidency should not be allowed to want such an institution[1]. We, therefore, authorize you to construct a suitable building for the reception of such astronomical instruments as you already possess, and to indent for such as may be necessary[2].

Though Hodgson welcomed the idea of an observatory, he would have nothing to do with a special field survey ;

Colonel Blacker appears to suppose a survey of the lower provinces of Bengal to be necessary. The orders of the Hon'ble Court are conclusive on this subject ; in their letter dated 29th October 1823 they say ; "It will not...be necessary, at least at present, to resurvey Bengal or Bahar, or any of the territory formerly surveyed by Major Rennell" [284].

The Surveyor General proposes that Mr. Warren should...march about...Bengal, making astronomical observations...during the dry season and return to Calcutta in the rains, where he would find abundant employment in the Surveyor General's Office, the intent of his field operations being to establish points for...survey [of] those low countries.

To this I answer that, if such surveys were required, the officers of the Bengal Army... would be each as capable...as any persons can be. ... A surveyor, to perform his duty, must be himself able to take the difference of latitude correctly. ... The officers of the Bengal Army who are surveyors...are fully competent ; ... they would be independent of the aid of a travelling astronomer...in the particular of latitude. As to...longitudes, or differences of longitude, they are likewise as competent, for the observations...are not difficult ; care and fidelity, are all that are required.

After describing the various surveys of the last few years [181], he continues ;

The duty performed by the surveyors is more effective than what would be done by a travelling astronomer, who would not carry better apparatus than the surveyors, and would do a partial duty at a greater expense. ...

Very exact surveys may be made in countries to which trigonometrical surveys cannot be extended, [though] it has been asserted that the Great Trigonometrical Survey is the only permanent foundation of Indian geography [185, 194]. A better foundation it cannot have in those parts of the country over which the triangles can be extended, ... but over the greater part of the most valuable of our possessions...the country is so flat and so covered with groves of tall mango and other trees...that it is obviously impossible to spread a triangulation ; but it is of little...consequence, as every desirable end of accuracy may be attained from the operations of skilful surveyors[3].

The idea of a separate astronomical survey was thereupon most rightly dropped, and surveys were extended beyond the western frontier under Hodgson's system of well arranged traverse circuits, with every surveyor providing his own astronomical control; but it was a system with severe limitations that Hodgson was never to grasp [24–6 ; 88–90, 180]. The return of Everest in 1830, and the enterprise with which he carried the great triangles across the Ganges valley to the Himālaya mountains gave the surveyors a far more reliable foundation than any astronomical survey, and relieved them of continual anxiety about the accuracy of their individual observations.

SURVEYOR GENERAL'S OBSERVATORY

Both Colebrooke and Crawford had been very keen astronomers, and had kept up observations at Calcutta after becoming Surveyor General [II, 191–3]. Mackenzie, though never shewing the same interest, had before leaving Madras consulted Goldingham who wrote shortly after ;

According to my promise, I sit down and give you my ideas. ... A public observatory...is an establishment for observing the heavenly bodies—to ascertain their exact positions & motions, with a view to the improvement of the tables &...of geography & navigation, by furnishing correspondent observations for determining the longitude of places, and also the data for enabling ships to take a correct departure—with sundry other matters. ...

Most enlightened princes have been proud to have such establishments in their dominions as, independent of their utility to science and navigation, none lead to discoveries so sublime

[1] Burrow's request in 1789 had been sternly refused [I, 162–3]. [2] CD to B., Mil. 4–5–27 (82–8
[3] DDn. 231 (14), 5–11–27.

regarding the wisdom, power, & goodness of the Deity; they also become a sort of focus for real science to emanate from[1].

Mackenzie was, however, far too preoccupied with administrative matters to continue observations at Calcutta. Hodgson restarted them as soon as he took over, to support the field surveyors with corresponding observations [I, 167–8; II, 195–6]. At the end of 1822 he asked for official help;

Some letters...published a few months ago in the newspaper, ... and afterwards reprinted in a pamphlet which I enclose herewith, very aptly pointed out the advantages of establishing an observatory in Calcutta. ... I do...for my own amusement make some observations, ... but to render them...of greater utility I...submit the following proposals;

1st. That I be allowed to purchase a circular instrument made by Troughton, of 15 inches diameter, the property of Lieut. Grant[2]. ...

3rd. That I be authorised to purchase a few books of reference on astronomical subjects for the use of this office. A favourable opportunity offers at the present moment. ...

4th. That the Honorable the Court of Directors be solicited to send out a transit telescope of 5 feet focal length, with complete apparatus—...A zenith tube on Captain Kater's plan, for observing the stars near the zenith—...A Kater's pendulum for determining the length of the pendulum—...Two reverberating lamps...for observing station points by night—...Two steel chains with 5 feet links—...The Greenwich observations for the last seven years, and it is desirable that they, and also those made at the observatory of Paris, be sent yearly. ...

I cannot...make an uninterrupted series of observations as is done in regular observatories, but I purpose, with the help of my assistant[3], to take those...most generally useful. ...

The two-feet circle...I have, since the close of the rains, mounted on a massy block of stone, cut as a support for it in the quarries at Chunar by the late Colonel Colebrooke, but never before used[4] [I, 101; II, 191].

At the same time, he wrote to Fallows, astronomer at the Cape [183 n.7], asking for correspondent observations to those recently taken at Calcutta, and sending two chronometers to have their rates checked[5].

Blacker was equally anxious to put the observatory on to a regular footing, with a staff of its own. He writes to Goldingham;

I have assembled a few instruments...and expect others, to complete a small observatory establishment, with which I hope to contribute (in a humble degree however) to the public service. ... I request of you some information regarding the forms which you use in registering your observations, calculations, rate of timekeepers and astronomical clock, with notices of such other phenomena as receive your attention. ... Whatever further information you may think proper to bestow on one who does not boast of practical knowledge...will be most gratefully received. ... You have occasionally supplied my predecessor...with...observations for geographical purposes, and I shall hope...to derive...similar assistance from you[6].

He pressed Government for a reply to Hodgson's letter of November 1822;

There are several [observations]...which appear to be indispensably necessary...—corresponding observations of occultations and eclipses for...longitudes—...thermometrical and barometrical heights...to facilitate...corresponding local observations—...observations for the apparent time...to estimate rates of timekeepers...on which all other observations depend. ... Orders of Government[7]...to [observe] the rates...of chronometers...have been found impracticable owing to the want of proper means for ascertaining the...siderial times. ...

I may...mention the remark made to me by more than one commander of ships navigating to England, ... having no place established under authority to which they might send their timekeepers while ashore, in order to have their rates regularly kept and ascertained. ... At present they are obliged to leave them with a watchmaker at a heavy charge, without any obvious security for the correctness of the time with which they are compared [II, 196].

In case Government should authorise time keepers belonging to ships being sent here, ... it would seem expedient that a trifling fee should be payable...for the benefit of the Register [214, 273], who will keep an account of the same, to ensure his attention to that duty.

He gave a list of instruments already available, and of others expected from England, and suggested structural alterations to the office building, No. 37 Park Street [311][8];

[1] DDn. 40, M 478; 16-7-17. [2] proceeding on mc. to Cape [71, 152]. [3] James Herbert [38, 309]. [4] DDn. 198 (135) 14-11-22. [5] ib. (168½), 26-12-22. [6] DDn. 223 (3), 9-1-24. [7] BMC. 28-10-17 & 17-9-19. [8] Also used as residence by Blacker and Hodgson.

The zenith micrometer[1]...I purpose...fixing in the ground floor, independent of the foundation of the house, and opening in the roof the small aperture necessary for its limited motion. The clock, transit, and circle, will be on the top of the house, where they will require protection from wind, rain, and sun. A wooden apartment must therefore be constructed for them, in part of which the roof will revolve over the circle, and over the transit a meridional opening will be fixed to pillars of masonry. The apartment thus constructed will be 23 feet long by 10 broad and 10 feet high, except over the circle, and will be capable of being taken to pieces and put together in any other situation[2].

All these proposals were sanctioned, and Blacker was allowed to entertain a special man to look after the instruments, Saiyid Mir Mohsin Husain, who had worked for him in Madras ;

A sicklegar...is allowed by the regulations [II, 290], but there is no instrument in the office which, if he were allowed to touch, he would not ruin. Numerous instruments have... become unserviceable because there was no hand...that could apply, at an early stage, small tho' delicate repairs. I accordingly procured such an artist as was competent...from Madras in room of a sicklegar, but necessarily at an advanced rate [Rs. 25 p.m.][3].

At the end of January 1826 he reported that the work had been completed at a cost of "sicca rupees 4,261-12-0" against an estimate of Rs. 2,536 ;

The observatory is removable, consisting of joiner's work made in the most durable and masterly manner. In fact, it is much superior to anything I had expected. ... The charge, "article 2" is for a machinery by which the rotary roof is turned. ... The small charge "article 5" is for establishing a mark in the meridian of the observatory on the top of...House No. 28 in Chunam Gully of the Bow Bazar. ...

Since the 1st of November last the...observations...have been, and continue to be, unremittingly pursued, at the same time that observations are prosecuted with those on the Ava river and Burampooter [182, 184][4].

Blacker made the observations himself[5] till, in January 1825, he obtained the appointment of an educated Swiss named Vincent Rees [313], to assist in

observations...with the calculations consequent on them, and as both these tasks require attendance both night and day, they are scarcely to be expected from a commissioned assistant, who has not a particular disposition towards so laborious an occupation[6].

From November 1825 Crisp, from the Hyderābād survey [119], was able to assist, and after Blacker's death reported that he was

continuing the observations of the transits of the heavenly bodies over the meridian, especially of the sun and moon ; lunar star occultations ; eclipses of Jupiter's satellites. The transits... are particularly required in order to deduce, with the utmost exactness, the differences of longitude for the correspondent observations in Ava [184][7].

On his return to Calcutta Hodgson made the observatory one of his chief interests, engaging the help, not only of members of the Revenue Surveyor General's office he had trained at Fatehgarh[8], but also of Mohsin Husain. He proposed to enlarge and move the observatory to the neighbourhood of Monghyr where better atmospheric conditions would be found. He rejected the assistance of Warren or any other outsider ;

The Hon'ble Court do not seem to be aware that they have at Calcutta a very efficient ...small observatory, ... fully competent...for the improvement of geography, and serving as a point to which all the astronomical observations made by the different geographical surveyors ...may be referred, and this...has hitherto cost nothing more than for...a wooden building on the roof of the house, the price of a few additional instruments of moderate size, and the salary of one individual [Rees], ... employed in reducing and calculating the observations made by myself and the young men, sub-assistants and apprentices, ... as a part of the current business of my office. The duties...of an astronomer are performed, but they cost nothing. ...

But, very useful as this little observing establishment is...to me in the execution of my geographical labours, ... the instruments...may...be considered as mere playthings so far as making further difficult investigations...in the high science of astronomy[9].

Government agreed that a special astronomer was not necessary, but refused to consider any further expansion of the observatory[10].

[1] Purchased from Lambton's executors [260]. [2] DDn. 204 (45–9), 4–2–24. [3] ib. (75), 14–7–24. [4] ib. (229), 31–1–26. [5] He sent copies to Pond, AR. ; ib. (152–5), 12–4–25. [6] ib. (135), 8–1–25. [7] DDn. 220 (146), 14–4–26. [8] under the supervision of W. R. James. [9] DDn. 231 (14), 5–11–27. [10] DDn. 217 145–8), 5–11 27

Results were sent for publication to the Bengal Asiatic Society and the Astronomical Society of London[1];

The operations...are unremittingly carried on...for no other recompense than the interest and instruction which they afford; but the results...will, I trust, be thought of much value by the London Astronomical Society, to which I hope the Hon'ble Court of Directors will be pleased to send the MS. details forwarded. ... Another series is in progress, and will be delivered in shortly, that correspondent observations may be readily obtained[2].

In 1852 Andrew Waugh notes that

the observatory was...on the most diminutive scale, being furnished with no more than a transit of 30 inches focal length, an 18-inch altitude and azimuth circle, a few astronomical telescopes of 5 feet and 4½ feet focal length for observing eclipses, and an astronomical clock. The meteorological implements were also on the same small scale. ...

This observatory had no pretensions...to be considered a metropolitan institution, nor was it at all fitted...to investigate questions of high scientific research. It was strictly an appendage to the survey department, ... furnishing a zero, or point of departure in latitude, longitude, and height above sea level, to the surveys in Bengal, and as such it has fulfilled the objects of its institution. ...

The observations...made were, from time to time, published in the Memoirs of the Royal Astronomical Society by the late General Hodgson, and have been favourably mentioned by the President in his notice of that scientific officer's death[3].

FIELD SURVEYS

Whilst stationed at Fatehgarh as Revenue Surveyor General, 1823–6, Hodgson established a private observatory of his own, and employed his office staff [314] on a series of observations for both latitude and longitude, the latter being supported by correspondence with Madras and Greenwich[4].

Fatehgarh became, therefore, an important point of departure for the surveys which Hodgson initiated during his second tenure as Surveyor General. Gerard was to extend his earlier survey of Mālwa and Rājputana [90], whilst Boileau made a rigorous survey of the lower *doāb* between Allahābād and Cawnpore, and ran a line to Agra with the view of surveying Bharatpur [24–7].

Hodgson wished to establish Agra as a reliable point of reference on which surveyors could base well controlled traverses. For Gerard's survey he proposed

various methods of astronomy, trigonometry, transfer of time, and other more common modes of measurement. ... Some place, extremely well settled in geographical position should be used as a point of departure. The Taj at Agra is such a point, and I am anxious that its position in latitude and longitude should be fixed in the best possible manner, that it may serve as a first meridian, not only to this survey, but to others in upper Hindostan. ...

We...know its position nearly to the truth [I, 168 ; II, 190], but still I am anxious that it should be more satisfactorily settled, and this can be done by Captain Gerard making... observations...by transits of the moon, and the eclipses of Jupiter's satellites, and other methods, which observations, being compared with those which I will take at this place at the time, will settle the differences of the meridians of Fort William and Agra. ...

The longitude of Agra will also be much supported by...a good measurement of the differences of its meridian and that of Futtehghur, and by the explosion of rockets [90, 182–3].

When the operations at Agra are finished, Captain Gerard might...determine the line from Bhopal to Ougein and Indoor ; this being chiefly difference of longitude, will be fixed by chronometers, explosions or rockets, or flashes of gunpowder, or triangulation, according to circumstances. Thence...up the nearly meridional line from Ougein to Jeypoor, fixing it by differences of latitude and azimuths, ... and the...outline from Jeypoor to Agra will be determined in the same mode as between Bopaul and Ougein [pl. 24 ; 89–90]. ...

Captain Gerard has...valuable instruments, his own property, but, as some of the larger description will be required, I purpose to intrust a very perfect circular instrument to him[5].

And later ;

[1] *JASB.* IX, 1840 (75–80) (*et seq*); *MRAS.* III, 1829 (344–58). [2] published, *As R.* XVII, part II, 1833 (8). DDn. 231 (85–8), 4–2–20. [3] DDn. 542 (336), 30–9–52. [4] *MRAS.* II, part II, 1826–7; 1–6–25 & 7–11–26. [5] DDn. 204 (255), 18–8–26.

Captain Gerard...proceeded from Calcutta by water in October last towards Futtehghur, there to commence...by determining the difference of that position with the Tajh of Agra...by the two-fold operations of making a minute geographical survey, and...by chronometers carried by dawk in palankeens by nightly runs between those places. ... This determination is of great consequence as the Tajh...will be included in the triangles of the meridional arc, and Futtehghur...I consider...better established than that of any place in the Upper Provinces not in sight of the snowy peaks. ... It was my object to connect Agra, Futtehghur, and Bareilly together, the last place being settled from the peaks [32, 178, 197–8][1].

As Gerard had fever the whole way from Calcutta to Fatehgarh, and off and on for the next six months, he was not able to complete the link between Fatehgarh and Agra, nor the observations required at the Tāj [90].

Hodgson then worked out a value for the longitude of Agra to be used for the Atlas of India. He connected his own value for Fatehgarh by the surveys of Dr. Hunter [I, 56] and F. S. White [II, 192]—Everest's value for Sironj, connected by Gerard's survey of 1823 [89]—various values for Delhi, connected by White's survey—and observations at the Tāj, mostly by two of his staff from Fatehgarh[2]. He deduced a value 78° 05′ 47″·2 [I, 168][3].

Hodgson gave Boileau elaborate instructions for his survey of the lower *doāb* intended to clear up the doubt regarding the actual distance between Allahābād and Cawnpore [I, 162 ; II, 190–1 ; III, 3, 24]. He concluded;

Regarding the longitudes of Allahabad and Cawnpore, ... you need not endeavour to ascertain the absolute longitudes ; ... it is *the difference of longitude* alone that is to be investigated. ... The flagstaff in the fort of Allahabad may be considered as your first meridian, and that of Cawnpore your second point of departure, though you will ascertain the...differences of the S.E. angle of the fort of Allahabad and the magazine ghaut at Cawnpore also[4].

As to the true longitudes of Cawnpore and Allahabad, ... they must depend on the difference by survey from Futtehghur, where more good observations were taken than have been obtained at any other place in the Upper Provinces except Seharanpoor [177].

I hope you will receive the circle safe, it is new and of Troughton's construction, though made by Gilbert, an inferior artist. However, if you pay great attention to the adjustments you will probably get good results[5].

Boileau found the line from Allahabad to Cawnpore

much less than...expected, and gives the *rough* longitude of the latter station 80° 17′ 31″·7. ... Mr. Burrow's longitude is 80° 13′ 30″, being about 4 minutes, or 4½ miles, too much to the westwards of Allahabad, agreeing pretty well with Colonel Colebrooke's opinion [I, 163][6].

and in acknowledging his final report, Hodgson was pleased to find that his

map...clears up the...confusion which has so long existed in the longitudes of the Upper Provinces, which arose from Mr. Burrow's mistake of nearly 6½ miles between Allahabad and Cawnpore. I feel the greatest confidence in your differences of longitude. Burrow, you will perceive, was right, or nearly so, at Allahabad, and Benares also. ... You see what confusion had been caused by this mistake of Burrow's who was considered as absolutely infallible, and it was deemed heresy to doubt any of his determinations[7] [I, 155–64, 318–9].

MADRAS

Most of the Madras surveyors had the very great advantage of working to the triangles of the Great Trigonometrical Survey, and were spared the exacting and tiresome work involved by astronomical observations [186].

Even though the Northern Circārs survey was soon extended far beyond the control of Lambton's triangles, the instructions given were clear ; work was to proceed by triangulation, and to be closed at intervals on measured bases. This did not necessarily mean that true direction would be preserved beyond dispute, but the deviation was unlikely to be noticeable for mapping purposes.

In his enthusiam for astronomical methods, Hodgson had asked that a telescope should be issued to Snell, for observation of Jupiter's satellites at favourable

[1] DDn. 204 (332), 8–8–27. [2] W. N. James & Winston. [3] The correction of—2′ 27″·18 to old value of Madras [II, 195] brings this to 78° 3′ 20″ as against true value, 78° 3′. [4] DDn. 220 (266), 7–9–27. [5] ib. (320), 20–2–28. [6] MRIO. M 348, 16–1–28. [7] DDn. 220 (331), 14–5–28.

opportunities. Snell's request for a timepiece came to the notice of Blacker, who wrote indignantly to Montgomerie, asking why the telescope had been supplied ;

As long as that instrument was not required for other purposes, ... there was...no objection to letting Captain Snell amuse himself with it. ... The case is altered when purchasing, at an advanced price, a time-keeper...to be sent to the Rahamundry survey, because that instrument cannot be expected back without injury, and can never be useful there, whilst the issue of it sanctions Captain Snell's deviation from his original instructions.

He was directed to proceed by triangulation, and to verify his operations by the measurement of a second base. ... Since the art of surveying was invented, there never has been known so monstrous a proposition as that of correcting triangulation by astronomical observations for the longitude. In the Great Trigonometrical Survey observations of the stars are made with a view to determine the latitudes, but this not with any design to correct the triangulation, but to ascertain how many fathoms are contained in a degree of the meridian.[1]

Snell explained that the telescope was of no use without the timekeeper. He did not want to "correct the triangulation", but to compare astronomically fixed positions with those derived from triangulation.

Snell was not the only Madras surveyor who took an interest in astronomy, for Crisp worked out a method "of deducing the longitude from the observed altitude of the moon"[2], and published "*A Treatise...upon the methods of determining terrestial Longitudes by the Moon's Right Ascension*", for which he asked Government support by the "allotment of fifty copies, at ten rupees per copy, for the use of the survey departments of this presidency"[3]. Hodgson noticed that

Captain Crisp has published his book at Madras. ... Various forms and modes of calculation have at different times been adopted by different astronomers for determining differences of longitudes from the comparison of the transits of the moon and stars, some of which, when I have leisure, I may probably extract for the use of such surveyors as use transit instruments. In this country they are coming into general use, and all the surveyors observe the satellites, but on your side you are independant of these things[4] [190].

Hodgson continued to encourage the Madras surveyors to obtain suitable instruments, not only to qualify themselves for taking observations when working beyond the range of the Great Trigonometrical Survey, but also for work in forest or other areas where distant view was impossible. At his request Montgomerie asked the Madras Government to help ;

As this Presidency will in all probability be the first to have parties available for regularly surveying the newly acquired territories to the eastward [after the Burma war], it would be desirable that officers in charge of surveys should be put in possession of those instruments. ... It would be well that the surveyors should have the means of being throughly practised in determining the latitude and longitude by observation, in the event that at any time they [may] be placed in situations where such a mode only may be available[5].

Goldingham had resumed charge of the Observatory in 1812, and in 1821 undertook a notable series of observations for ascertaining the length of the seconds pendulum. Apparatus was sent out under the auspices of Kater and, after preliminary work at the Observatory, an expedition was sent to Sumatra under Crisp, to carry out observations near the equator [254–5].

When Goldingham took furlough pending retirement in 1827, Montgomerie was posted to charge of the Observatory in addition to his duties as Deputy Surveyor General, receiving an allowance of 100 *pagodas* a month[6]. On Goldingham's retirement in 1830, Thomas Taylor[7] [257] came out from England as astronomer, and held charge till 1848.

COLABA OBSERVATORY

There was no observatory at Bombay until the Directors made a grant for the purpose to the Bombay Literary Society in 1818[8]. In August 1821 they were told

1 DDn. 223 (19–20), 5–1–25. 2 ib. (177–9), 1–8–25. 3 copy still held by compg. office at Dehra ; DDn. 147 (364–6), 26–1–27. 4 DDn. 223 (53), 27–7–27. 5 DDn. 222 (2), 12–1–27. 6 about Rs. 350. 7 Thos. Glanville Taylor (1804–48) ; *DNB.* ; *RAS. mn.* IX. (1849) (62–3). 8 Bo to CD. 3–8–18.

that "the observatory has been erected in the s. w. ravelin under the directions of Mr. Hereford[1], and some valuable instruments purchased by the Society". Hereford died "shortly after the building was completed" and, on the recommendation of the Society, the Directors appointed John Curnin as "Astronomer to the Company" on Rs. 500 a month. Curnin was "reported to be well versed both in astronomy and in natural philosophy, and his merits...attested by...Mr. Henry Colebrooke". The appointment was urged to meet "the inconvenience experienced by the trade and commerce of the port from the want of scientific assistance"[2].

Curnin arrived from England in 1823, and, reports Government,

> after repairing and adjusting the instruments and examining the position of the observatory belonging to the Literary Society, he has represented to us that the instruments are not of a magnitude nor of a kind sufficiently accurate for the extension of science and the good of navigation, and that the present observatory is unfit for a depository of good instruments. ...
>
> We...suggest that the instruments recommended...be made in England by the artists whom he has named. ...
>
> We have authorised a spot of ground on Colaba pointed out by Mr. Curnin to be made over to him for the purpose of an observatory[3].

A new observatory was constructed during 1826 by the Chief Engineer in consultation with Curnin, at an estimated cost of Rs. 16,794–2–05, on "a vacant space belonging to Government immediately south of Mr. Morley's premises on the Island of Colabah"[4] and was enclosed by "a permanent wall made round the compound", a small gap being left with "a little iron railing" through which observation could be made to "the meridian mark to the north"[5].

Two papers by Curnin were published by the Royal Astronomical Society on transits of moon-culminating stars[6], and amongst the Astronomer Royal's correspondence is a letter from Curnin dated Bombay 10th June 1824, reporting that he had

> a new method of determining the latitude at sea, which I purpose soon to send to the Board of Longitude, ... that the Board would give me a premium for it [I, 151][7]. ... I very much regret ever having come here ; my prospects are far from being agreeable or bright.

Being obviously unhappy, he refused to work with the instruments supplied by the Directors in 1824, and sent them back. It was held in London that there was "no shadow of a foundation" for their rejection, and he was dismissed in 1828[8].

Markham records that

> other instruments were sent out in 1835, and remained unpacked for five years. The transit instrument was put up at last in 1840, and since September 1841 a regular register of magnetic and meteorological observations...has been kept.
>
> The office of the draughtsman of the Indian Navy was afterwards removed to the observatory [133], ... and here the chronometers of the Indian Navy and merchant vessels were rated, and the charts...compiled, drawn, and occasionally lithographed[9].

1 Roger Francis Hereford, watchmaker, d., Bombay, 10–5–20, possibly connected with R. F. Hereford, of Bo. Mil. Dept. Sectt., 1853, and with family of Sufton Court, co. Hereford. 2 Bo to CD. 29–8–21 (86–94). 3 Bo to CD. 10–9–23 (19–21). 4 BGC. 29–7–23 & CE.'s 10–10–23. 5 ib. 20–6–26. 6 *RAS*. (*mn*), I (24, 78) ; 1828 ; ib. *Memoirs*, III (369). 7 not found amongst Board of Longitude papers at Royal Obsy. 8 CM. 2–4–28 ; CD to Bo. 21-5-28. 9 Markham (23).

CHAPTER XIV

PROFESSIONAL DETAILS

Policy — Himālaya Districts, 1816–22 — Assam & Burma, 1824–8 — Plains of Bengal — Barometric Heights — Madras — Bombay.

IN their orders for a Surveyor General of India [II, 306; III, 274, 289–90][1], the Directors defined his duties as the compilation and maintenance of suitable maps, and the preservation of surveys and maps in a high order of secrecy. It was further implied that he alone would be responsible for technical advice and for control of all surveys of all three presidencies [303].

Mackenzie's own idea of what was required was based on his survey of Mysore [II, 91–112]; a detailed one-inch survey district by district, based on triangulation, showing all administrative boundaries, and accompanied by descriptive and statistical memoirs. Methods would vary with the nature of the country;

> The practice I established on the Coast[2], and wished to recommend here [Bengal], is to have the complete map of a province, or district, accompanied by a descriptive memoir; ... the limits particularly are described and all their landmarks; the experiment has been made, and succeeded. To carry it on, two preliminaries are necessary—a small establishment of native assistants[3] trained to surveying and drawing on one uniform system—an entire subordination throughout, by which the progress can be instructed, watched, corrected, or approved, as circumstances require [II, 303].
>
> The surveys should never be interrupted till the district is finished, and then the surveyor should have his due share of reward or praise, in the regular channel. ...
>
> I find near me a copy of the heads of memoir descriptive of a province, used in Mysore, and attempted by me to be introduced into the Dekan. ... And what a noble work would result! What a clear view of British India! Time, perseverance, and an organized machinery are only wanting. ... A central office of direction and control will always be necessary[4].

Though the Madras surveys were organized on these lines, and long continued with valuable memoirs, district by district, such memoirs were undertaken in Bengal by the revenue surveyors only.

For survey of the Marātha Deccan [124–5] Mackenzie advised

> having each circar surveyed separately at first. General maps are formed from them. ... This method is a medium between the endless method of separate village surveys, and the loose method of general topographical maps, which never complete anything, and for ever require corrections. Every village and feature is laid down in this middle way[5].

Hodgson was sceptical as to the Great Trigonometrical Survey reaching all parts of India, and strove to develop systematic traverses, controlled by regular astronomical observations.

> Much remains to be done; and, as it is to surveys of a combined geographical and military complexion that we must owe it (because they are most rapid in their execution, and *when connected by astronomical observations* sufficiently correct), I will confine these remarks chiefly... to their still greater perfection, as well as uniformity.
>
> Though in such surveys trigonometrical observations, proceeding from bases measured with care, are *occasionally* introduced for special purposes, it is rather a waste of time in general, and in close countries not applicable.
>
> Great trigonometrical operations, ... while they determine such important and curious facts as the true dimensions...of the globe, ... most materially assist and correct the operations of the surveyor who works...within...the determined triangles, ... and save the surveyors on

[1] CD to B. 3–6–14. [2] of Coromandel, a familiar reference to the Presidency of Madras [I, 143, 264]. [3] country-born [I, 283 n.8; II, 303; III, 94]. [4] DDn. 154 (35), 7–9–18. [5] to Resdt., Poona, 7–9–18; ib. (7).

the Coast the necessity of using the more valuable astronomical instruments. But, even then, such are necessary to the surveyor *when accompanying armies*, and in many other situations in which he cannot avail himself of the connecting points of the great triangles [185–6, 191][1].

Blacker was not an experienced practical surveyor like Hodgson, but during nearly ten years as Quartermaster General he had much to do with surveyors and maps ; he had known both Mackenzie and Lambton personally, and had an immense respect for orderly method and system. He became Surveyor General at a moment when the future of the Great Trigonometrical Survey was under serious consideration, in view of its extension into Upper India under a new Superintendent, and he possibly discussed the new Atlas of India with members of the Court of Directors before he left England in 1823 [282–3, 300–1].

One of his first concerns was to make a careful review of all surveys in progress, to ensure that they were being conducted on uniform principles, and were fit material for the new atlas [120–1]. With this view he writes to Mountford two months after taking over ;

One of the great objects for instituting a general office of survey was that...a uniformity ...might be obtained, and a definite prospect (however distant) procured of accomplishing the survey of India on satisfactory principles. ... The operations of the Great Trigonometrical Survey must...be assumed as the undisputed ground of Indian geography. ...

Madras Presidency enjoys the peculiar boon of containing the first measured base of the great triangulation, and of being covered with the same, excepting on the coast from Masulipatam northwards.

It will be a future task to re-transcribe...the records of valuable surveys in such a manner as shall readily exhibit...the observations, measurement, calculations, and consequent field book, with the dependence of one part on another. Until this shall be accomplished, the geography of the country cannot be said to be established, for otherwise, were its survey even correct, the truth thereof cannot be shown [121, 292][2].

He discusses the possibility of extending surveys in Upper India with astronomical control only [89, 186] ;

No survey can be pronounced final unless performed with the best instruments, on the most approved principles, and by competent surveyors. ... In many...cases the rudest instruments have been used—the principles...imperfectly understood—and persons...employed who were incapable of even correcting for the variations of the compass. ... Yet were...these imperfect operations beneficial to the public service, because some information regarding boundaries and newly acquired territory was absolutely necessary, and, however imperfect, ... was better than total ignorance. ...

There is every reason to suppose that Government will...require similar surveys for special cases, that cannot await the more tedious progress of correct methods. ... To reduce this inconvenience, ... no survey liable to...supercession should be undertaken except for special purposes ; ... all the talents suitable to the task of performing final surveys shall be applied to that purpose. ... This...leads...to the nature of the Great Trigonometrical Survey as the only permanent foundation of Indian Geography. For many years there was no certain prospect of its...being extended into Hindŏostan, and there was therefore sufficient reason...for prosecuting other surveys on this side of India entirely independent of...it. The case is now altered, as the last prospectus...sanctioned by Government provides for the immediate extension of the Great Triangulation into Hindoostan [225, 233, 240][3].

He went on to suggest the provision of well-fixed astronomical points to provide control in those parts of Bengal that might be beyond the reach of the trigonometrical survey [185–6].

He wrote about the same time to Sutherland, emphasizing the importance of preserving original documents ;

Not only must all observations, calculations, and results, be satisfactorily detailed, but all the topographical objects which enter...the map should, as far as possible, be described in writing, under whatever form of field book may be adopted, and where that description may fail, a local sketch in the field books should supply the deficiency.

Finished maps...will differ with different systems of projection—mistakes may occur both in the calculation and protraction of a triangulation and in the insertion of the detail—

[1] *Remarks on the Surveys in India*. DDn. 196 (154–66) & 282 (297), 21–11–21. [2] DDn. 220 (3–6), 22–12–23. [3] DDn. 204 (9–16), 26–12–23.

alterations take place in the dimensions of the paper with changes in the atmosphere, and very similar effects are produced by subsequent pasting—all of which...must be for ever perpetuated, unless there be some independent test for correction. In short, there must always remain on record sufficient means for reconstruction of the plan at any time, or the records must be deemed imperfect, and the fruits of labour and expence proportionately forfeited. ...

The same fate has attended, on this side of India, the several constructions of successive Surveyor Generals [*sic*], all of which have been set aside from the total absence of explanatory memoir ; for...there are no means of separating the dross from the metal [I, 225, 239][1].

Early in 1825 he submitted a review of the surveys fit for the Atlas [120-1] ;

Surveys...founded on minor triangulation have been deemed final, in the expectation of their...ultimate correction by the Great Trigonometrical operations. ... Madras Presidency is nearly completed, and...much has been finally effected on the side of Bombay. ...

The next class of survey is that...founded on careful road and boundary measurements, with observed bearings, ... systematically planned...with a view to the complete survey of some district or province. This principle is inferior...to that of triangulation, but it has its merits, which may remain a tolerable substitute until a final survey can be effected. Of this description are the majority of the surveys...executed under the Bengal Presidency. ...

Our geographical knowledge of the parts...which remain...depends on...casual route surveys. ... In some cases astronomical observations have been employed for their correction, but under no view can those parts be considered as topographically or certainly known[2].

He insisted that no work was suitable for the Atlas unless on scale of at least one inch to a mile. He did not agree with Sutherland that the half-inch scale was "sufficient to represent every description of country"[3].

After Blacker's death, and Everest's departure to England, Hodgson saw the prospect of the Great Trigonometrical Survey reaching Upper India more remote than ever, and continued his policy of pushing survey westward with the best astronomical control that could be provided [89-90]. Before leaving India, January 1829, he submitted a note which doubtless led to Bentinck's important memorandum [196], from which the following passages are quoted ;

In examining the...materials from which the Indian Atlas has been compiled, it appears that...the only really valuable part of the work has been furnished by the geodetical operations of the late Colonel Lambton. ... It...proves...the least expensive of the Indian surveys, in-as-much-as it is the only extensive one which needs not to be made over again, and affords facility to all further surveys of whatever description [I, 190 ; II, t-page]. ...

The mode in which the great surveys are carried on in England furnish the most useful precedents. ... The first operation is establishing the positions of the primary points, and furnishing the great basis. ... The second...is the carrying on secondary intermediate triangles and determining as many points as may be required for the third sort of operations, which consists in filling up the with topographic details by means of inferior instruments. The second and third, combined, have been executed upon an extent of 14,000 square miles by the officers of the Military Institution of Madras [95-6]. ...

It may be proposed ;

A. To continue the work of Colonel Lambton northward as far as the mountain provinces ; Captain Everest, for whom the continuation has been kept open, may be expected soon from England with a new set of first-rate instruments constructed for that purpose. ...

B. Bases are not wanting from which officers of the three Presidencies may carry on intermediate triangles, and determine a sufficient number of points to serve as basis to the topographical sections into which the district given to each officer is to be divided.

C. In filling up these sections under-surveyors are to be employed, and are to use chiefly plain tables, which are...of easy construction, not expensive, and procurable in every country. The smallest scale upon which topography may conveniently be taken up in the field has been found to be that of two inches to the mile.

After a lengthy discussion about the detail survey, which displays the influence of Troyer far more than that of Hodgson[4] [193], Bentinck concludes ;

Whatever time may be required, and whatever mode adopted, certain is it that a work of such magnitude will never be completed, nor any satisfactory result insured, without the establishment of a permanent system, independent...of the rapid changes of Surveyors General. ... Upon all these considerations it is proposed ;

[1] DDn. 220 (6-8), 1-1-24. [2] DDn. 204 (142-4), 31-1-25. [3] DDn. 220 (39-43), 18-5-24.
[4] Bentinck was Govr. of Madras 1803-7, with Troyer on his staff [II, 447].

I. A military survey upon a scale of 2 inches to the mile shall be carried on in the three Presidencies[1] ; ... to begin in the countries nearest the present frontiers, in the most important or the least known parts, ... and to be extended towards the sea coast.

II. Two officers of each presidency are to be permanently employed in carrying on... secondary triangles from bases furnished by the primary geodetical operations, ... and to superintend the topographical surveys...performed by 10 under-surveyors. ...

III. This surveying branch, consisting, for the three presidencies, of 6 officers and 30 under-surveyors, is to be kept always complete ; their number may be augmented, but shall never be diminished[2].

A reference to these proposals was made by Thuillier about twenty years later ;

Lord William Bentink [*sic*], Governor General of India, in his masterly minute, ... lays down the first principles on which a large country should be surveyed in the soundest and most practical manner. The system, ... however, was not followed out in all its integrity, but the Great Trigonometrical Survey was permitted to proceed, as a skeleton operation[3].

Though Bentinck's proposals were never implemented, Everest claimed that the priority given to his principal triangles was in full accord with them[4].

HIMĀLAYA DISTRICTS

An account has already been given of Hodgson's unsuccessful attempt to base his triangulation of Sirmūr and Garhwāl on observed differences of latitude—the repeated astronomical observations taken by himself and Herbert in pursuance of this attempt [175–7]—and their eventual resort to the measurement of a base-line [37]. Their triangulation extended over the hill area between the Ganges and the Sutlej, and from their stations they cut in all the prominent snow peaks. A list of the points fixed was published in *Asiatic Researches* [38 n.5, 178].

It is difficult to conceive how any adequate survey of these hills could be effected without the planetable, but neither Hodgson nor Herbert had any knowledge of this instrument, though it had been most successfully used by Garling in the hilly country of Goa, and was being used in the mountains of Coorg at the very time Hodgson was making his survey [97].

After laying down his framework of fixed points, and takings heights by barometer, Hodgson cut in by theodolite the villages and rivers that could be seen from his hill tops. Detail was filled in by compass traverse along hill paths and streams, with frequent checks by astronomical latitudes. Distances were measured by perambulator, by pacing, or by time, as circumstances dictated. Herbert describes how he dealt with the winding of paths, and reduction to the horizontal ;

The distances I have put down as determined by pacing. The value...is of course continually altering with the nature of the road. I have considered 2,000 equal to a mile ...a sufficiently correct idea. The course I have put down by estimation, as there was not really time to protract the route, travelling 6 and 7 miles a day in a mountainous country. One hour is the average time for a mile, and the fatigue is so great that it is quite impossible, after arriving at the ground, to sit down immediately to copy field books or protract.

Frequently I have not reached my ground till 3 or 4 in the afternoon, and sometimes not till nightfall. On such occasions a little rest is absolutely necessary. I have been most anxious to prevent...arrears, but I have...found it impossible without halting, which...I was averse to do, as...the season was already too far advanced[5]. ...

An excellent theodolite was used for the bearings, distant points being freely used as checks on the protraction. The distances were determined by time. Such a method will be thought perhaps loose and inaccurate, and so no doubt it is ; but...such is the rugged nature of these roads that, in whatever manner the measure be taken, it will require to be reduced ...before...protraction. ... This reduction must depend entirely on estimation. ...

I had well exercised myself in the number of paces which may be taken within the minute, on every quality of path, and...this number was always inserted in the field book at the time, as was likewise the reduction of the road line to the straight one for protraction[6].

[1] The 2-inch scale was adopted for the NW. frontier area in 1905. [2] DDn. 263 (68–82) ; submitted to Council under GG.'s minute of 3–9–29, and passed to SG. by Mil. Dept. 13–11–29. [3] Thuillier & Smyth (232). [4] DDn. 402 (133–49), 1–4–41. [5] Fdbk., DDn. 137 ; M 322, Aug. 1818. [6] Survey of the Sutlej valley, *As R.* XV (411).

He kept one particular man to pace the distances, and generally ran the perambulator at the same time as a check. He found by experiment that on the level the pace varied from 32 to 34 inches, and in the mountains from 23 to 27 [51]. He tells Oliver in 1821 that

route surveys in the mountains are not capable of the same precision as in the plains. ... The reduction of an inclined waving line to the horizontal one for protraction...can never be very exact. ... The eye acquires some facility after practice. ... It is desirable to have as many points of...verification as possible; and...it a good rule to make 8 or 10 miles the greatest distance depending on a mere route survey.

The daily distance that can be effectually surveyed...—arranging and copying the field book—protracting the route—making and calculating the necessary astronomical observations—I am inclined to fix at 5 to 7 miles. ... 5 miles cannot be well surveyed in less than four hours. ... I have never been able to do more than 2 miles an hour.

He goes on to describe theodolite resections and intersections [II, 212 ; III, 28] ;

Of the several methods of fixing a position by means of others already known, I...prefer the angles which 3 points subtend. ... If they have the one the same longitude, the other the same latitude nearly, as the place of observation, the result will be very satisfactory.

If but one point be visible, besides observing the azimuth of it, it will be necessary to know the latitude of the station. Finally, when the difference of level is great, the barometer affords a very good method of connecting stations at moderate distances, and if corresponding observations can be had the result will be still nearer the truth. This method in particular is excellent for fixing the course of a river. From a lofty station a few bearings and depressions will afford data for as correct a map of a river's course as could be had by actually following and putting down its tiresome windings[1].

He records an interesting case of measurement by subtense distance ;

The distance of the cantonment at Dehra, ... not having been measured by the perambulator, was determined as follows.

The angle subtended by a well defined object at Nalapanee (Captain Y's bunglow)[2] was measured with considerable accuracy by employing the theodolite as a repeating circle, and from thence, knowing the dimensions of the object, the distance was computed. In like manner, using other objects, and observing occasionally from either place, ... results were obtained, the mean of which it is imagined must be near the truth[3].

The following extracts from Herbert's fieldbooks tell of the measurement of the base-line at Dehra Dūn in January and February 1819 [37] ;

It may be thought that with a chain...all that was necessary [was] to have coffers made for it. But the employment of the chain in this way would have consumed...time, not only in the operation itself, but still more in the preparation of the coffers and stands, the latter requiring to be made with elevating screws. ... At this remote station one such stand could not be properly executed. ... I was alone in a work which requires at least two to execute it properly. ... I relinquished the idea of employing the chain, except as a standard of comparison, for which purpose it was invaluable. ...

It appeared that the best substitute would be a set of rods constructed of pine-wood; the comparative unalterability of this wood has been long known. Such rods have been even employed...in the measurement of a degree, particularly by La Caille and General Roy [226][4].

This month [January 1819] was occupied in preparing the rods, ... their stands, ... the alignment pickets, etc. ... On the 30th Decr....a line of 21,000 feet had been run, free from any serious obstacles. On the 1st Jany. commenced clearing the ground. The 3rd and 4th, rain prevented much progress being made ; a flagstaff was procured with some delay for the alignment. ... The evening of the 4th, I proceeded to the southern extremity, distant 3 miles from Dehra, and fixed my camp there [37 n.7]. ...

By the 10th the flagstaff had arrived, ... a fir spar of 50 feet in length. A machine... contrived for detecting the alteration of the measuring rods...from moisture, etc., was finished about this time, with the exception of the divisions, the cutting of which caused delay.

On the 18th, the base being cleared, I commenced the rough measurement with a common land-surveyor's chain, putting down strong pickets...at every 500 feet, and mumbering them. On the 20th I had got up the flagstaff at the northern extremity. ... The 21st was occupied in setting it truly perpendicular by...wooden braces and a plummet. ... 22nd, rough measurement continued. 23rd, ... various matters relating to the rods, particularly...the first attempt

[1] DDn. 152 (166), Oct. 1821. [2] Frederick Young (1786–1874) Ens. 1802; comdg. Sirmoor Batt. 1815–1843. [3] Fdbk. 3rd July 1817, DDn. 137, M 322. [4] Fdbk. DDn. 168, M 366.

to determine their length. The 25th, the rough measurement was completed, and found to consist of 43 spaces of 500 feet each, besides 266 feet over, 21,766 feet.

The remaining days of the month were occupied in repeated...determinations of the lengths of the rods as compared with the brass scale; also in preparing and setting up an apparatus for the chain. ... During this period also, I commenced the final and correct alignment of the base, previous to commencing the measurement. This was effected by using the circular instrument as a transit. ... The latitude of [the south ?] extremity was observed, ... and found to be 30° 16′ 44″.

On the 1st February, the final comparison of the rods with the steel standard chain was made, and, being found to confirm the previous determinations made from the brass scale, I commenced the measurement on the following day. ... Progress made the first day was... very trifling, being only 150 feet, but as the people got accustomed...we got on quicker. ...

1,182 feet measured 1st March...terminated the base, giving 21,732 feet[1].

Webb based his survey of Kumaun on astronomical latitudes only, without any ground measurement [44–5];

The base is a line nearly in the meridian. ... The latitude of each end was carefully observed, and the angle of an azimuth made by one of them with the meridian through the other was astronomically observed. ... Length of this base then calculated assuming the length of a meridional degree to be 60,600 fathoms.

[Triangles extended from this base had all three angles observed, and were computed by plane trigonometry].

Latitudes of each station computed from triangles, and...agreed so nearly with celestial observation that it was doubtful which might be in error. ...

The geographical position of the great mosque at that place [Pīlībhīt] had been given by Mr. Burrow, and I purposed adopting it as the first meridian of my survey. From a point close to the mosque, observations were taken to 3 known snowy peaks, and the latitude worked out from these observations came within 5″ of Mr. Burrow's. ... I next computed the difference of longitude of all the stations from Peleebheet, using a table of meridional parts. ...

Being now assured that the distances given by my survey were trustworthy, I worked out the heights, assuming refraction 1/18 of intersected arc [48].

Observation from four known peaks gave mean height for Kalimath station as 5,767 feet—maximum 5,878—minimum 5,652—and the heights of all points and villages whether by barometer or vertical angle, were adjusted to this value.

I flatter myself that in the more essential parts this survey will bear comparison with any that have been performed in Bengal, and I can only lament that I have not been able to collect the materials into a map of suitable external appearance [II, 453; III, pl. 6][2].

ASSAM & BURMA

The surveyors who accompanied the various military columns during the Burma war, 1824–6, had to rely mainly on compass traverse, with distances measured by perambulator or time, and frequent astronomical latitudes. Many of them had to work in boats along creeks and rivers where accurate measurement was impossible. The countries they were traversing were, however, so little known, that any information was of the utmost interest, even though not of great accuracy [194]. The following is an extract from Schalch's instructions [53 n.1];

It is not intended that you should confine yourself to a mere road survey of the line of march. The features of the country, so far as...visible, ... you will be careful in delineating, laying down the hills by triangles, ... of which your surveyed line of march will form the base.

The courses of the rivers...you will also be careful in ascertaining by actual survey to the greatest practical distance, & you will endeavour to supply from information the general direction of the streams beyond the limits of your survey, the names of the towns or villages near which they flow, the situation of their sources, and their junction with other streams or the sea. The section of rivers of any magnitude should be taken, shewing the depth of water in the dry season & during the floods...and, if near the sea-coast, the rise and fall of the tide.

Large scale plans of passes—villages—towns—population—cultivation—crops, etc.

[1] Fdbk., DDn. 137, M 322; about 300 ft. difference of level. [2] *As R.* XIII (263 et seq).

As the tract...is supposed to be rich in the precious & base metals, you will also...ascertain the situation of mines, and...procure specimens of ores in their natural state, which you can take an opportunity of return carriage to send to the Presidency, being careful to label minutely every distinct specimen. ...

Climate; ... —barometer—thermometer—...compared with ones in Calcutta. ...

The detailed map...half an inch to a mile...you will reduce to a general map...8 miles to an inch, *inserting the reduction on a sheet of drawing paper on which lines of latitude & longitude* have been previously marked, according to the master sheet...with these instructions.

Plans of positions to be made on...six inches to the mile, & particular attention...paid to the relative heights. ... In the map sheets you will be careful to insert both the true & magnetic meridian. All places laid down from information you will distinguish by a blue colouring[1].

For measuring distances by boat in Arakan [68–9], Wroughton asked for a log-line as used by sailors ;

I found it utterly impossible...to determine, with any degree of accuracy, distances...from a knowledge of time alone. The constant variation of the flood and ebb tides, together with other impediments, rendering the progress by water so very uncertain. ...

Log-line...is sufficiently accurate...and, its being accompanied with a wheel and clock similar to the perambulator, spaces moved over in any known time are at once pointed off without confusion. Captain Crawford of the Bombay Marine informs me that he is in possession of an instrument of this description, and that he is willing to dispose of it for a small sum (probably 60 to 80 rupees)[2].

When he resumed office as Surveyor General, Hodgson found much to criticise in the fieldbooks and sketches ;

Your style of execution is very neat, ... [but] I would suggest...that you...write the names in rather a stronger hand, and make future maps, whether from reduced survey or information, on the scale of 4 B. miles to an inch, making the construction and lengths of degrees according to the enclosed form[3]. ... Be very particular...in your maps, sketches, and notes, in distinguishing between what you have *actually observed and surveyed yourself*, and what you have inserted from information only, and always state the name and condition of the persons from whom you gained information[4]. ...

Do not trouble...about fine paper and highly executed maps ; ... sketches and maps fade ; make them as correct as you can, of course, and distinct ; ornament is of secondary consequence ; too much time is occupied by it. We make copies here to send to England and for other uses, and the originals are lodged in the office[5]. ...

Send maps...with parallels of latitude divided to 30′ and meridian lines to 20′, strictly according to the table ; ... and these lines to be continued to a properly divided margin, with a scale of miles and local measures of the country. ... As to the meridian, you have merely drawn one line, and written the longitude along it ; but have afforded no means by which I can judge how it was determined, nor indeed since you went away have I received any note of survey, or observations of latitudes and longitudes. ... I am engaged in constructing a general map of the eastern parts, ... and require *authentic materials, and correct differences* of longitude are most requisite[6] [182–3].

Pemberton explains that the traverses recorded in his field books show

lines infinitely more numerous...than is generally necessary in a geographical survey, but the mountains over which we travel are so closely wooded that it very rarely happens a line exceeding two furlongs can be obtained, and the average are much shorter ; this renders the subsequent calculations excessively laborious and, until the arrival of Lieut. Gordon [66], they occupied a very considerable portion of my time[7].

Grant based his survey of the Irrawaddy entirely on astronomical observations [183–4], and he had but little opportunity for triangulation in Tenasserim ;

To triangulate the Attaran...even partially would be a tedious, if not an impracticable, operation. ... It is...particularly desirable to take advantage of the season for astronomical observation, and to determine the latitude of as many stations on the river as may be practicable, and finally the latitude of the pass [into Siam]. From these, combined with azimuths, no doubt the country to the south-east may be partially triangulated, but I think, upon the whole, the positions in that quarter must be founded on the transference of time [180–1].

From November till the beginning of March no triangulation can be carried on owing to the dense masses of smoke with which the atmosphere is loaded, and which renders it generally

[1] DDn. 214, 20–12–24. [2] DDn. 215 (21–3), 23–11–25. [3] Lithd. in Calcutta; DDn. 220 (101, 109 19–9 & 15–10–25. [4] to Wilcox, 17–11–23, ib. (176–8). [5] ib. (261), 28–8–27. [6] to Pemberton, 30–3–27 ib. (221–3). [7] DDn. 204 [323], 3–5–27.

impossible to see objects more than three or four miles distant [76], but this is the season peculiarly adapted for determining latitudes from meridian altitudes of the sun. ... After this month the sun will not be visible on the meridian by reflection, and my wish is to reach the Siamese frontier before that [184–5]. ...

I do not anticipate much difficulty in laying down the Gayen river (the course of which is from east to west) partly from azimuths and latitudes, but chiefly from azimuths and transference of time. The triangulation...will embrace...triangles whose sides extend 8 to 15 miles in length. ... Such appear to be the only practical method of laying down...fixed points, from many of which detached perambulator surveys will be practicable[1].

Hodgson warned him that astronomical fixings alone would not make a survey ;

It would be of little or no use to merely know latitudes or longitudes in a new country if we did not know all the particulars of the communications. ... For instance, what would be the use of the difference of latitude and longitude of Amherst and the 3 Pagodas without a road survey between the places, affording such information as an officer commanding troops would require on his march ? ... *The wheel* is the foundation of all useful work, ... and I hope you will not despise it, but use it whenever you can, for we must get a full survey...from intersecting lines, ... for a country is surveyed if all the lines of communication...are surveyed[2].

Hodgson's insistence on the perambulator shows that he had no idea of the difficulties of the jungle-clad hills of Burma, where the only communications are by river or village footpaths. Grant replied that he would make such perambulator traverses as he could, but that it was essential first to survey the main rivers, and this could not be done by perambulator. He pressed for special allowances ;

There are no villages in the interior from which men or provisions can be supplied, and after each survey...the surveyor must return to this place [Moulmein], and thus half the month is lost in supplying...provisions, and a new set of carriers if he can obtain them. ... No surveyor is competent on the ordinary allowances to meet such enormous expences, for he must pay for the transport of the supplies for the whole party. ... The labourer deserves his hire, and if Government require perambulator surveys in the interior, I am quite sure that these circumstances require only to be stated, to obtain its sanction to a monthly contingent charge for the heavy expenses. ...

It will not...be practicable...to commence perambulator surveys till January ; before that...the survey of all the rivers...will probably be completed[3].

The following are Grant's instructions to De Montmorency in October 1827 [77] ;

The monsoon being now entirely at an and, and the weather sufficiently settled to admit of your proceeding immediately on the rivers, you will...proceed up the Gayen river towards Tounsa, and...lay down by careful magnetic and angular intersections the several islands between that village and Moulmyne[4]. ... You should proceed first to Tounsa, where there are several eminences whence you will be able to form a just idea of the features of the surrounding country. ... These ridges you will be able to lay down pretty accurately from magnetic bearings from the banks of the river. ...

You have now enjoyed a recess from active duty of six months, and...you should exert yourself to the utmost. ... Every surveyor is expected to be constantly employed in the duties of the survey exclusively, and during the favourable season to devote his every hour, and his every thought, to it, and to it alone[5].

PLAINS OF BENGAL

The general system of survey in the flat tree-covered plains of Upper India was to run wide traverse circuits, with frequent checks by astronomical fixings and, after a satisfactory closing, to fill in detail by minor traverses. Surveyors working in the more hilly areas were able to make use of triangulation and measured bases, always controlled by observations for latitude and azimuth, as thus described by Franklin [81–2] ;

My operations were conducted on the practice of primary & secondary triangles. ... The primary points were extended by a large base, measured trigonometrically, and also by latitudes, between two temples situated on the hills of Banda and Seundah, and verified by another base similarly measured between temples on the hills of Chatterpore & Mow[6]. Intermediate

[1] Moulmein, 10–2–27 ; DDn. 220 (224). [2] DDn. 220 (226), 5–4–27. [3] DDn. 221 (234), 17–5–27. [4] MRIO. 176 (13, 14) show rays obsd. by De Montmorency. [5] DDn. 230 (305), 18–10–27. [6] Banda, 63 C/7 ; Chhatarpur, 54 P/9 ; Mau, 54 O/4.

small bases were frequently measured for constant verification, & under the probation of repeated astronomical observations, a complete series of points was established[1].

For Cheape's survey of Chittagong [11–2],

crosses were dug in the ground at every station that no mistake might be made in bringing the line of survey round again to the same point, and the chain was examined every two or three days and shortened when requisite[2] [I, 198 ; III, 172].

Seetacoon and Dolphin hills[3] have been laid down from bearings, and their positions made use of wherever they were visible ; bearings have been taken to a number of other hills. The height of Seetacoon Hill has been determined with great care from bases at the foot. ... Angles of altitude, as well as horizontal angles, ... have been taken with theodolite to the nearest 2″ ; ... they have always been repeated more than once to avoid the possibility of errors from the moving of the instrument.

From Islamabad there is a hill visible in clear weather at N. 72° E. ; ... it is visible from no other part of the district, but I should consider it about 64 miles distant, in which case it will be 5,600 ft. high, its angle of altitude being 28′ 30″[4].

Gerard took particular care over his traverses in Sahāranpur [22] ;

The routes have been surveyed in a more exact manner than...usually done. ... I spared no pains to make the outline correct, so that, by having it accurately laid down, the cross routes might be measured with greater expedition. ...

I set out from Najibabad, surveyed to Rusoolpoor, from thence back by another route ; as both the roads be generally in a line not far distant from the meridian, the latitudes observed correct the distance ; the differences of longitude depend entirely upon the bearings of the road, which were observed with the greatest care.

Harkaras with flags were sent ahead to mark the direction. ... The theodolite was twice set, read off to single minutes ; the distances by perambulator were put down to the nearest 1/10 furlong ; the whole was afterwards twice worked by a traverse table extending to every 5 minutes of the quadrant, which brings out the furlongs to 5 places of decimals.

The variation of the compass was observed generally once a week by the large theodolite ; the latitudes were observed from Dr. Pond's stars, always north & south, so as to do away with any error in the sextant & uncertainty of refraction. The position of Najibabad, after surveying to Rusoolpoor and back, comes to within 1/10 furlong of its former place, which is as near as can be expected in a measured distance of near 270 miles[5].

Under Hodgson's instructions for areas beyond the western and southern frontiers, each surveyor was to lay out parallelograms about 35 by 20 miles, and to follow the long sides alternately with the diagonals, finishing with the short sides, taking astronomical observations and frequent intersections [180] ;

The surveyor is expected to march each day from 5 to 7 miles (Sundays and Thursdays excepted) ; a halting day may also be allowed when an observation for the longitude by Jupiter's satellites is made. ... The time...by equal altitudes, if the weather allows. ...

It may sometimes be proper...to measure a base and to take angles for...fixing...any remarkable hills which...may serve as referring marks. If favourable ground can be found, a base of from 2 to 4 miles may be measured, and a short and a well-proportioned series of triangles carried on. ...

It only remains to admonish the young surveyor to be distrustful of himself and of his instruments, and not too confident when he finds his operations agree with a surprising closeness, but to examine all, and when he finds his discrepancies not to conceal them, but patiently to investigate their cause, and repeat the work till he is satisfied. Young observers think they are always right, but not so the more experienced [t-page].

The map to be sent to the Surveyor General is to be on 4 British miles to an inch. ... The protraction should be made daily, and in a large sheet, comprehending as much as possible of the tract to be surveyed ; the surveyor then sees at once what he is about[6].

Though not able to inspect surveyors in the field, the Surveyor General kept a close watch on their fieldbooks, and Hodgson writes severely to Ferguson [88] ;

These unsatisfactory documents...do not in the least resemble the form...I gave you. ... Instead of a separate field book for each month, ... in the form prescribed, with a daily traverse table, and...a register of the astronomical observations, ... and instead of...field notes which might have exhibited...acuteness of geographical research, ... I have received a most slovenly

[1] *Memoir of a Survey on the SE. frontier of Bundelcund* ; Franklin, 20–6–20 ; MRIO. M 269. Map, SW. Frontier, Bundelcund, with note on construction, MRIO. 83 (12). [2] Report, 14–10–19. [3] Sitākund Hills, 79 N/10. [4] Called Blue Mountain on his map; Fdbk. 1815–7 ; MRIO. M 257 ; see also Report, 14–10–19 MRIO. Misc. 20–0–19. [5] DDn. 212 (3), 25–11–18. [6] DDn. 196 (154), 21–11–21.

paper, which resembles...the route of a corps which the commanding officer occasionally directs some officer to keep, and for which, when well executed, he receives 100 rupees per month [II, 326]. But from a surveyor I might have expected something better. ...

The numerous erasures of dates and...figures, ... and the substitutions, ... require explanation [II, 218–20]. ... Very few villages, mountains, or remarkable objects, are intersected, ... and after the 5th of February I do not see...an observation of the needle of your theodolite. ...

Original field books are...sent to England. ... Imagine how persons who might there examine your field books, in the hope of finding full information on such interesting subjects as the heads of the Soane, Nerbuddah, and Hutsoo [88], would judge...of them[1] [II, 219–20].

He writes more kindly to Johnstone [87–8] ;

As I am well satisfied with your assiduity, ... you are not to imagine that in directing your attention to methods of greater accuracy I am finding fault with you ; on the contrary, I am more satisfied by seeing the discrepancies in your observations *faithfully recorded* than I should be by seeing any attempt to make them *close more nicely*, by which people sometimes deceive themselves, but *cannot deceive me*. ...

The Malwah map will...require more correction. Captain Gerard has the...task of defining the great outline and the position of the principal places, as that can only be done by a person of...experience, ... in the possession of...good instruments. He has laid down the line from Nurwar to Bopaul [89]. ... I will desire him to send you the correct protraction of the southern part...which you may consider as a correct framework to which to adjust your detail. ...

It is best always to arrange your survey in circuit...as recommended in the MS. paper of hints I sent you [88]. When you have made a round, the agreement of the sum of the... distances on the meridian and perpendicular will shew the goodness of your work. It will not indeed do so exactly, because of curvature, but that difference is beyond the power of your instruments. ... The best way is always to observe flags or some well-defined mark[2].

Gerard writes of his circuit through Mālwa that

from Jypoor to Kota I have great reason to depend upon the survey, which was done by means of azimuths & latitudes. ... From the latter place to Neemuch, which for upwards of half the way had never been travelled by a European, the survey will probably be...as correct as most of those made by a perambulator & theodolite, for the road generally led thro' a very thick wood. ... Even with my flags, upwards of 20 feet in length, I could seldom see 100 yards before me, so the bearings...are not at all to be depended upon[3].

Contrary to Mackenzie's practice in Madras, the Bengal surveyors were expected to work single-handed, and it was some time before Gerard obtained any help.

When I was surveyor to the Board of Commissioners [22–3], I had three country-born assistants, besides a European draughtsman[4], so, with the exception of the survey of the route, & astronomical observations, I had little to do compared with the enormous deal of trouble I have had with the survey from Agra to Bhopal, ... [where] I had not a single assistant to help me. ...

I had to survey the route, make enquiries regarding the supplies, water, rivers, boundaries, &c. Then, as long as the weather was moderate, equal altitudes for the time, & circum-meridian of the sun for latitude, were observed every day, ... and at night the altitudes of several stars. ... I was often obliged to sit up very late. ... Besides this, I had to choose stations for signals, frequently from one to three miles off the road, & now & then I visited these spots without halting a day for that purpose. ... Moreover several short bases were measured, sometimes with the chain, but oftener with the perambulator[5].

The instructions given to Boileau [24], and his reports, are a further illustration of Hodgson's system. He was to run down his circuits from traverse tables, and project his map from a table giving the lengths of a degree on meridian and parallel.

There are those who suppose that to make correct surveys by taking the various roads which intersect a country is a task of...great ease. ... To run a loose line of 100 miles seems easy, but if a great circuit is to be made and the line to be crossed...many times from different points, and in different directions, ... much tact, ... skill, and experience, are necessary. ...

You should use running camels as flag bearers. ... I would recommend your keeping 2 or 3, for...they are most convenient in bringing supplies, etc., from the nearest stations, and many other purposes. ... Perhaps you may prevail on the Judge to lend you 2 or 3 horsemen to carry your flags quickly [II, 202]. ...

You should change your guide, or Domha, at every village ; they will then willingly accompany you, and point out all the villages in sight...when you dismount to take bearings, and it

[1] DDn. 198 (52), 29-5-23. [2] DDn. 198 (60), 12-6-23. [3] Journals, MRIO. M 311, 507 ; from Sironj, 28-3-23 ; letter to SG. 7-6-24. [4] Blandford [23 ; pl. 3]. [5] MRIO. M 312, 21-4-24.

is best to give into the Domha's hand a hog spear, or long bamboo, with which he will point, ... while you look...over his shoulders.

You should take advantage of any mounds or heights near the road side to get a more commanding view of the horizon, and in the evenings do the same from your camp, or its vicinity. ... I rely on you for making your notes explanatory, ... and your map usefully full, though there is no need to crowd it with very small hamlets[1].

In acknowledging Boileau's map a year later, Hodgson congratulated him on the close of your surveying campaign; it has been an arduous one, and I return thanks for your exertions and attention to my...instructions. You see how rapid and correct this mode of surveying is, and...when we can dispose our lines...in such directions that observed latitudes afford a check and scale for the distances on the meridian...we have little to regret that we could throw...triangles over our flat countries like the Dooab, studded with mango topes.

If we could divide our ground into oblongs, and run up and down, with the difference of longitude and favourable diagonals, we might...make our map...as accurate, very nearly, as by trigonometrical operations. ... Certainly I would always determine points by triangulation ...when circumstances allow, but when they do not, as in the greater part of the rich Gangetic provinces, we can perform our work without them. A triangulation to be good should be on a large scale; ... but we see...ridiculous operations called Trigonometrical Surveys, which are merely a confused entanglement of...network of small sides, which...create...delay to no purpose whatever[2] [210]. It is really ridiculous to hear the grandiloquence which is put forth about trigonometrical surveys by those who know nothing about the matter, and who do not seem to know that in reality the measurement of a cabbage garden is...a trigonometrical operation[3].

The following extracts are taken from Boileau's later fieldbooks;

October 1st 1828. Marched from Agra towards Bhurtpoor...making use of two perambulators; No. 1 by Cary; No. III, the large, or Seringapatam wheel [I, 199]. Measured a line of 10 chains in the afternoon, and compared both the perambulators with it (chain No. 577). Wheel No. I gave only 218 yards by 4 measurements, and...No. III gave 220 yards by 2 measurements. Chain was of 66 feet. ...

[At the end of each day's march, distances resolved into eastings and southings].

6th November. The difference of latitude by perambulator between the Taj at Agra and camp at Horub, October 31st, is 42′ 22″·14 N. Added to the latitude of the Taj gives... 27° 53′ 44″·14; ... by meridian altitudes of the sun, 53′ 39″.

This is quite as near as I could possibly expect...during a whole month's run, and indeed so near a coincidence is very suspicious, but I have...been unable to detect any error...though always on the look-out. ... The daily runs have hitherto agreed very fairly with the observations of latitude made each day with the large sextant, and this instrument agrees very well with itself...(four observations agree within 9 seconds).

The diference of latitude per traverse between the Taj at Agra and the Jumma Musjid at Delhi is about 1° 27′ 30″, which, added to the latitude of the Taj, would give...28° 38′ 54″ for the Jumma Musjid. ... The real latitude, however, being 28° 39′ 13″, my traverse must be 19″, or 1/3 mile, short of the true distance in a run of 150 miles. ...

31st December 1828. In coming to close for the second time on...the Taj, ... I have... the following results of my 3 months circuit. ... Having never crossed the same line twice during a distance of nearly 300 miles, ... the total of errors...accumulated...will be...about 3/4 mile. The total difference of latitude per traverse between the Taj at Agra and the Jumma Musjid at Delhi...—via Deeg, 1° 27′ 21″·43...—via Ally Gurh, 1° 27′ 14″·62. ...

11th January 1829. Every morning...as soon as my outdoor work is finished, I...calculate the traverse and, having thus obtained the extreme points, ... I prick off the difference of latitude and departure...from the last fixed point, and then protract each bearing and distance, seriatim, beginning at the fixed point and terminating at the calculated extremity. ...

In this manner each day's work is laid down upon each successive sheet of foolscap, which are so marked...as to be laid out...in one large map, and at the close of the season the whole are transferred to a single sheet by pricking through the principal fixed points, and then filling all details with a tracing frame, by which means a faithful copy...is obtained[4].

BAROMETRIC HEIGHTS

The use of barometers for finding height was stimulated by survey in the Himālaya, but the surveyors had the greatest difficulty in carrying these delicate

[1] DDn. 220 (272), 11-9-27. [2] Possibly referring to S. Konkan survey by Jervis [126-7, 210].
[3] DDn. 231 (158), 9-7-28. [4] DDn. 227, M 324; foolscap sections, MRIO. 29 [3-14].

instruments about, and the long glass tubes were constantly breaking [221].

Hodgson ordered two barometers from England, but on his river journey from Bihār [179] he had only one, with which he took regular readings, keeping notes as to their apparent reliability and variation with phases of the moon[1].

The barometer...hung in the centre of a heavy pinnace which, towing in calm weather up the stream, had little inclination ; but it was always kept adjusted by a plumb lead. The thermometers, attached and detached, being also in the shade, close to the barometer, seldom differed more than two degrees.

This barometer was broken on the Chaur peak, and Hodgson found the loss "most mortifying indeed"[2]. He laments that "a set of mountain barometers sent for me from England was mis-sent by the Calcutta customs house to Bombay & are lost, & without doubt broken"[3]. A year later he was joined by Herbert who brought up two new barometers from Calcutta, but these were soon out of action, and neither Hodgson nor Herbert were ever successful in filling spare tubes [33]. They were left to find height by theodolite and sextant, and by boiling water [34–5]. It was not until 1821 that Herbert received other barometers and, with corresponding observations made in Calcutta, was able to get a satisfactory height for Sahāranpur, their base station [38] ;

Barometrical observations for height of Belleville Station, Saharanpur. This important point, it is hoped, is satisfactorily settled from 18 corresponding barometrical observations made at Saharanpur and Calcutta for that express purpose. ... On the arrival of a *perfect* mountain barometer in Calcutta, an actual contemporaneous comparison was immediately instituted with a similar instrument at Saharanpur—1,013 feet is the height of Saharanpur above the sea[4]—and the whole list of places fixed by the survey has been altered to conform. The series of 18 observations was made in August 1821.

Herbert never mentions Gerard's height for Sahāranpur, that was ascertained by the mean of at least 120 observations taken with two mountain barometers, which read off from the surface of the mercury to 1/100th part of an inch. At Dehra I had only three observations of the barometers before they were broken[5].

Of their independent surveys to the upper Sutlej [40–3] Gerard writes that Herbert had no barometer, whilst I had two of the very best. ... Herbert's heights were calculated from the boiling point of water. ... At Soobahtoo he made several comparisons between his thermometer and my barometers, and a difference, ... sometimes a degree and a half, ... was no uncommon experience...from the difficulty of making the water always boil the same. ... Besides, Herbert had no correspondent observations, whereas I always had, at Soobahtoo or Kotgarh, or both. Even Herbert allowed that my heights were more accurate than his[6].

Gerard took barometers on all his expeditions into the mountains [40–2], and for his surveys in Mālwa [89–90] he made a continuous series of observations from Sabāthu to Bhopāl, a corresponding set being observed at the Surveyor General's office. The series began in October 1822, with readings at least six times a day, and continued during his halt at Gwalior, June to September 1823 ;

I was unwell the whole of August, and on the 25th...I was attacked with a violent fever, ... with an inflamation of the liver & spleen, which confined me to bed for upwards of a month. ... The observations put down afterwards were observed by...officers at the Residency, but they were not regularly taken, and from 13th September were discontinued.

Calculations were made both by La Place's formula, and also by Dr. Maskelyne's method, which always gives the altitudes of very elevated places too little, because the equation for the latitude is not taken into account. ... I have worked the observations according to both rules, as by so doing any error is discovered.

With his brother Patrick he maintained observations at Sabāthu for four years, the mean of observations at 10 A.M. and 4 P.M. giving the best value ;

Some people reckon the barometer a very uncertain mode of determining heights, & this is true when imperfect instruments are employed, or when the places are remote from the tropics, and contemporary observations are not taken.

He describes the process of boiling the mercury so as to dispel the air ;

I have paid particular attention to barometers for these last 8 years, ... and, with the exception of my brother James [40], I have perhaps had more experience with these instru-

[1] DDn. 113, M 473 ; Jan. 1816. [2] MRIO. M 575, 1–7–16. [3] ib. M 380, 5–2–17. [4] true height 904 feet ; MRIO. M 358. [5] Gerard to SG.; DDn. 212 (15), 25–11–18. [6] Lloyd, II (3).

ments than any person in India ; moreover, from a constant residence of four years in the hills, I possessed advantages over most people, & I have had opportunities of measuring altitudes, both barometrically & trigonometrically, with instruments of the most perfect kind, which were even carried to the vast height of 19,450 feet.

My brother & I measured upwards of a thousand heights at all seasons of the year and, when we had an opportunity of comparing the trigonometrical with the barometerical calculation, the difference very rarely amounted to 40 feet in altitudes of 6,000 & 7,000 feet, when the observations were taken in...October, November, March & April.

He made Sabāthu 4,091 feet above the Surveyor General's office at Calcutta, or 4,129 feet above the sea[1], taking the office height from "an accurate series of levels observed by Captain Schalch" [14][2].

For his survey of Kumaun [pl. 6] Webb had " the best instruments procurable in England", but within a few months had broken no less than six tubes. He fitted new ones and got new barometers, and at the close of the survey had six for sale, all in good order[3]. Using five barometers, he obtained a height of 757 feet[4] for Kāshīpur, as against his preliminary estimate of 650, and in June 1817 fixed the height of Kedārnāth temple at 11,897 feet[5], and of Nīti Pass at 16,814[6] [46–8]. Over 400 correspondent readings were sent up by a friend[7] in Calcutta every month, and Webb preferred using the mean

of the Calcutta observations for five days, to...that directly correspondent with my own. ... In steady weather [several] series of observations give the same results as nearly as possible, though made at very different times of the year ; but the continual travelling about, which my business as a surveyor requires, seldom permits observations to be made in a continuous series[8].

Blacker asked Bombay and Madras to collect correspondent observations over as wide an area as possible ;

I have been engaged for some time past in preparing sets of barometrical tables for the calculation of relative heights, and have collected the observations of the barometer for many places. ... I wish them for so long a period back as may be had, and that, with the date of each observation, should likewise be specified the hour of the day. The height of the barometer should also be accompanied by the height of the thermometer for the same instant. ... I hope you will not think this letter a bore ; its object is entirely for the public service[9].

He told Montgomerie at Madras that

there ought to be a mountain barometer and thermometer with each survey. There is one, I perceive, with the Hyderabad survey, and I hope it is employed. There is likewise one at the Presidency, with which the late Captain Mountford used to keep a register[10].

He asked both Grant and Bedford to keep regular observations and arrange that

your barometer should be preserved free from injury until...it shall reach Calcutta, where it may be compared with the standard instrument in this office. Should you have occasion to carry your barometer to the top of any remarkable eminence, ... observations may be made at ...—sunrise—between 8 and 10 A.M.—noon—4 P.M.—or sunset. Corresponding observations for these times may be had in this office. Enclosed...is a small pamphlet on the subject[11].

William Cullen, of the Madras Artillery, was another barometer enthusiast and, during 1821 and 1822, collected and compiled records stretching from Cape Comorin to Sabāthu. This was an immense work, very carefully and clearly plotted, with excellent vertical sections[12].

MADRAS

Surveyors in Madras had the inestimable boon of Lambton's trigonometrical survey which had been completed over the southern peninsula by 1810, relieving them from all anxiety about the accuracy of their bases, and from the uncertainty

[1] True value about 4,500 ft. [2] to SG. 27–2–24 ; MRIO. M 507. [3] DDn. 198 (17), 2–2–22 ; Webb quotes " *A companion to the Mountain Barometer* " by Thos. Jones, optician, of Charing Cross. *JRGS*. IV, 1834 (379). [4] approximately correct. [5] pl. 6 ; 11,760 ft. [6] 24 m. NE. of Badrīnāth, 16,628 ft. DDn. 150 (104) 1–10–20. [7] probably Alex. John Colvin (1786–1861) ; BCS. 1805 ; Jt. Magte. Suburbs, Calcutta, 1817 ; or his father, Alex., merch., of Colvin, Bagett & Co. ; *JRGS*. IV (376–7). [8] MRIO. M 373, 30–9–20. [9] to Warden, Ch. Sec. Bombay, 31–12–24 ; DDn. 223 (15–6). [10] ib. (21), 2–2–25. [11] to Bedford ; DDn. 220 (101), 19–9–25. [12] Rev Bd. 11–4–22 *et seq.* ; maps & sections MRIO. 97 (13-39) ; *IO Cat.* (91–2).

of astronomical observations [94, 190]. In spite of Mackenzie's anxiety for uniformity of system, however, he left each surveyor to take up the detail by theodolite traverse or planetable, as he considered best. Surveyors trained at the Military Institution and many of the assistants from the observatory training school favoured the planetable, whilst those trained under Mackenzie favoured the traverse.

Travancore is a difficult, wooded, mountainous country, and though Ward admitted the value of the planetable for the most detailed survey, he found it

necessary to have the whole section covered with...points...not exceeding 3 or 4 miles from each other. ... When stations are at some distance, the lines drawn from them to the place of observation from 3 *stations...would scarce meet in one point*, ... &...a compass whose diameter is about 4 inches should be used to enable the surveyor to set his table. ...

I have had the environs of this place surveyed with the table on a large scale. Tho' the space did not exceed 3 square miles, & with the aid of a number of points, it took 10 days to complete, which...is a long while for so small a tract. A person...feels awkward...in the beginning, but after a few days practice it becomes easier & may be used with facility. ...

It is useless in a hilly & woody country where very often one has not a glimpse of his points ; the surveyor must then have recourse to measurements & the compass in the usual way. I regret having brought three of them ; one...is all I require, & in lieu of the others I should be very glad if I can get another small handy theodolite & a wheel[1].

His own task was to fix points for his assistants by triangulation ;

Bird...has unfortunately been confined with a fever the whole of this month. ... I have been out a few days to the north and succeeded in surveying a pretty extensive tract, ... & came in the day before yesterday & succeeded in laying it down in the plan. ...

The climate among the hills is supposed to be more wholesome during the rains, and soon after it, but to approach their vicinity in the warm weather is generally thought dangerous. ...

I supplied Turnbull with...triangles, as well as could be obtained, & mostly well defined points. He must, I find, previous to commencing the survey, place flags on them, of which I cannot see the propriety of ; a flag or tree on a table hill or bluff is...necessary to define the ...station, but to trouble the inhabitants to place them...on every hill...causes a loss of much time[2].

My own time is just now occupied in carrying on the triangles ; and...a series of inferior ones are necessary, which gives me a good deal of trouble...owing to the apparent flat surface of the country. ...

The gentlemen employed...under...Captn. Arthur [II, 131–2] appear not to have taken any notice of the Divisions in their survey. I have had opportunities of comparing their sections, ... & find they have been minutely laid down ; even in the most intricate parts have they observed the details with such a nicety that if that survey was allowed to go on in the same style, I believe it could not even now have been concluded.

I have only observed one deviation from our method ; they have...carried on...without consulting a Register of Villages ; the consequence is that for every ten villages, on an average, only one has been inserted on their plan, & these appear to be the principal in each sub-division[3].

The country to the N.E. of Quilon, up to the mountains, appears as an ocean of wood, with scarce one imminence above another. The query is how a series of triangles...is to be carried on. You will by an inspection of Coll. Lambton's triangles see that his points are from 20 to 50 miles apart, which must have been owing to a want of defined objects[4].

After Conner's arrival greater use was made of the planetable, with triangulation still the essential basis [110].

Mountford's survey of Guntūr [96–7] followed the style of the Military Institution [II, 215–6], though more attention was now paid to boundaries and villages ;

The trigonometrical operations of Colonel Lambton form the basis...from which intermediate stations were determined. ... The instrument...was a common nine-inch theodolite, by which the three angles of the principal triangles were generally observed, and the excess or deficiency added or subtracted. ... The...survey having been divided into sections (as...by the Military Institution) of 6 by 4½ miles [II, 128 ; III, 120], the principal stations, ... were referred...to the section lines, ... parallel to the meridian and perpendicular [of Carangooly, II, pl. 16].

The stations being laid down by the distance from these lines, their correctness was ascertained by measuring the distance from each other [216]. Four, six, or eight, of these sections were allotted to each assistant as...convenient, ... having as many hill stations as possible protracted...to aid in laying down the detail.

1 DDn. 156 (185–6) 16–11–16. 2 ib. (187–9), 28–11–16. 3 ib. (204), 28–3–17. 4 Swinton's triangulation [II, 243–4] ; ib. (190), 28–11–18.

The principal villages have been registered...by their bearings from two...stations, or by the bearings of these stations from...the village, ... by a theodolite or small circumferentor [229]. (In some cases these angles were taken by the plane table, and afterwards measured by...protractor)[1].

Much confusion was experienced with village names, not only from differences in pronunciation and doubtful transliteration, but even from the existence of two or more forms of the same name, or from the use of a name in the official list that was never used by the villagers. Mackenzie insisted that the surveyors should follow the lists supplied by the Collectors [II, 213 ; III, 105]. He writes to Sim, who had found particular difficulty at Pondicherry [98] ;

The accuracy of the survey of the Military Institution has never been doubted. ... The intention of your present survey...is to...identify the names of the villages in the Collector's list, to be delivered up bye & bye to the French. As all the villages do not appear in the plan of the Institution, you are to enquire for them by name, & to mark them out on the maps. ... It appears to me very uncommon that in the short space of 16 years from 1793 to 1809, such a number of villages should change their names. ... I wish you to be sure of this.

He answers Sim's enquiry—

whether it be necessary to examine the boundaries surveyed by Summers—Certainly it would be useless to employ him & for you to go over it again, but, as you...doubt...the degree of responsibility attached to you, it is proper you should satisfy yourself, as the intention in sending an officer is to give a greater degree of authenticity to the work. ...

But if we are to go over the whole of the work done by every assistant, what is the use of employing them by themselves ? ... What I should recommend...is to go upon the ground, ... to observe the method followed, to enquire into it, & approve of it if satisfactory, leaving to him the detail. You can try one or two instances. What is wanted is the boundary of the French territory in general, not of every individual village[2].

Garling commenced his survey of the Nizām's dominions in Raichūr Circār, where the country was not favourable for planetabling as Goa had been [II, 158] ;

The Nizam's country being divided into...circars, ... these divisions...and their subdivisions into purgunnahs, samoots, talooks, ... are to be...the foundation of the survey. ...

Previous to...the survey of the boundary of a circar, the surveyor should have established a certain number of primary stations ; ... with these and...secondary stations...the situation of every village in the district should be ascertained. The groundwork...thus laid, the exterior boundary of the district should be next traced, and the landmarks...described. ... Any doubtful or disputed boundary should be noticed. ...

In...tracing the boundary, ... the cusbas, forts, towns, and villages, coming in the way, or lying on either side, should be laid down by angles with the stations or adjacent fixed places ; others may be taken by occasional excursions. ...

The results...should be protracted in sections for the map as early as possible. ... One English mile to one inch is recommended for the provincial maps of the districts, and the names of the principal cusbahs, those of the inferior divisions, and the forts, should be distinguished, either by the mode of writing, or some marks of reference[3].

In his final report, Garling gives a lengthy description of the formulae by which he computed his co-ordinates and concludes,

The detail has been taken up by bearings with the compass needle of different telescopic instruments upon tripods, and made to answer as circumferentors. The stations have been for the most part taken at villages, with a view to meet the instructions of the Surveyor General that bearings from them to the principal points should be registered[4].

In his triangulation of the Sagar Circār to the north [115 ; pl. 18, Suggur], Garling observed all three angles of his primary triangles so far as possible,

but, the country consisting of...broad swells of such nearly equal height, ... no very commanding spots could be found[5]; it was constantly necessary, on reaching an advanced signal flag, to make some change in its situation, and thus lose the observations recorded, which are for the most part the mean of 6 or 8 readings of the angle. On the whole...sufficient data has been obtained to give assurance of its *general* accuracy. ...

The table of elevations and depressions...exhibits greater irregularities than could be wished, but is...sufficiently accurate for all practical purposes[6].

[1] MPC. 97, Gen. No. 23, 414 (1–3), 1817–8. [2] DDn. 156 (41), 13–5–16. [3] Mackenzie to Garling, 18–4–16 ; DDn. 202 (84–90), & MPC. 10–5–16. [4] DDn. 101 (1), 1–8–18. [5] Such ground would be equally unfavorable for the planetable. [6] DDn. 104, M 185. 11–4–19.

In his report for season 1824–5 Crisp writes that the whole area for survey

was subdivided into...field-sections containing each about one hundred square miles. ...

One uniform system prevails among my assistants. The instrument...to which their practice has been invariably confined is the theodolite. The daily work is noted in a field book, the left-hand page containing the angles and bearings, and the right-hand page a rough topographical sketch [II, 214]. ... The materials thus collected are immediately protracted and delineated accurately upon a field section book, and the whole work of the season, on returning to quarters, is embodied into one large map...by the two ablest draughtsmen[1].

Montgomerie had called for this report in order to meet Blacker's classification of surveys fit for incorporation in the new Atlas of India [120–1, 283]. Snell at the same time reported from Vizagapatam

that two of the assistants survey with theodolite and keep field books, etc., one only making use of the plane table, the...method...most efficient and approved. As...the others have been for a long time accustomed to that manner of surveying, it would not...be advisable to introduce any other system among them, which would...retard their operations for a time. Generally each assistant introduces his own portion of survey into the fair maps[2].

Montgomerie was as ardent an advocate of the planetable as Garling [II, 216], and strongly urged its general introduction

instead of the field books which are now kept. ... The results obtainable by...field books are undoubtedly satisfactory, yet, with...much more labour and time, neither the same detail nor the same degree of accuracy can be obtained...as with the plane table. ... The greatest, and perhaps the only, objections to the use of the plane table hardly exist in this country, whose surface is seldom enclosed, and whose climate, with respect to its dryness, are peculiarly favourable to the employment of this simple instrument. ...

Captain Steel and Lieutenant Cunningham...adopted the plane table with the greatest advantage [125 ns.6, 12], and...each of these officers had minutely and accurately surveyed upwards of 7,000 square miles per annum with that instrument. ...

The quantity surveyed by Captain Crisp and five assistants during the present season amounts only to 5,500 square miles ; but, admitting that each assistant could accomplish the survey of about half as much as...Captains Steel or Cunningham, the party would perform as much in one year as under the present system is now done in three years. ...

The adoption of this plan would not interfere with the present...village register. ... The boundaries of districts could also be laid down and described with as much accuracy as at present, and the distance from one landmark to another along the boundary could be measured by...perambulator, as well as the principal roads. ...

Surveying with the plane table is so very simple that I have not the least doubt but that the whole of the assistants would very soon acquire a perfect use of it. This was the case with the surveyors employed on the Travancore survey [119, 206]. Mr. Turnbull, now in this office, ... states that they made greater progress with that instrument than with field books, which...they had previously been in constant practice of. ...

I...suggest the system of sections as adopted by the late Captain Garling. ... The scale of one mile to an inch would, in general, be sufficiently large for surveying with the plane table. ... These sections, at the conclusion of the season, ... should be separately copied out fair, and put up together in a small case, with an index, in the manner adopted by Captain Garling. ... Thus arranged, any hundred square miles of the peninsula could in one moment be produced, and the whole of the original surveys...could be contained in a number of convenient sized volumes, and...be preserved with the greatest care for ages[3].

Crisp did not like the planetable and preferred

angular instruments, ... especially...the theodolite. Perhaps indeed it is the only one which can ensure correctness and certainty. ... All the observations made with it become a matter of record, telling in words and significant signs what the plan represents in the dumb show of lines and colouring. Its superiority over the plane table for accurate delineation is manifest. The latter is a vague and indeterminate instrument, leaving its results unfurnished with data by which to verify the operations and ascertain their accuracy.

The chief use of the plane table [is]...to take a rapid sketch of a small tract of country. ... It may also be usefully employed in furnishing a spirited outline of a range of hills, whose apices have been previously determined by the theodolite. For such purposes it is well calculated but, since its deductions are produced by a mechanical process so that the loss of the plan is irrecoverable except by...a fresh survey, it should give place to an instrument of higher pretensions[4].

[1] DDn. 183, M 173, 184 (392), 9–6–25. [2] DDn. 202 (33), 1–6–25. [3] DDn. 202 (147–53), 24–6–25. [4] DDn. 147 (342–8), 8–12–25.

Mackenzie had similar views, and regretted that Pickersgill and Garden had not made a careful theodolite traverse along the Nepāl frontier [19] ;

Why could they not follow the method so well observed by your son & by Mr. Auber ? [II, 436]. The plane table is well enough for giving the fact of a plain space, but for a limit with a Foreign Power that may hereafter be subject of discussion, something descriptive is wanted[1].

The Hyderābād party was withdrawn from the field at this time, and field work was not resumed until January 1827, shortly after which Crisp resigned [119]. Montgomerie returned to the charge in a letter to Webb, who relieved him ;

The practice...of taking up the topographical detail of the survey by...angular instruments and field books is so inadequate to the faithful delineation of...an extensive and diversified surface, that I...recommend your introducing that valuable and simple instrument, the plane table, into general use. ... Although long practice has made these assistants partial to the use of field books, yet I am convinced that the sooner they are generally abandoned, so much sooner will advantage be derived to the service.

By using the plane table many sources of error will be avoided ; the time which the assistants take up in protracting the work at home will be saved, and any inaccuracy committed at one station is immediately detected and corrected on the removal of the table to another.

Field books will only be necessary when surveying with the perambulator in measuring the high roads, or in a close country, when no other instruments than the perambulator and compass can be made use of[2].

In November 1828 Montgomerie recommended that, in default of fieldbooks, the work of the planetablers should be supported by copies of their journals ;

As surveys are conducted under this Presidency, ... it would only retard operations were the surveyors required to send in field books monthly, and as the detail is chiefly taken up by ...the plain table, the subordinate surveyors have little occasion to use field books. ... The best check...would be to make officers...send in monthly copies, not only of their own diaries, but of every individual employed under them, ... and as writers are now authorised to each of the surveys copies of all diaries could be made out without interrupting the work[3].

From this time all officers joining the Hyderābād survey were trained in the use of the planetable and that instrument was adopted as the normal means of survey right through the Madras Presidency. It was through the appointment of Du Vernet to the Himālayan party of the Great Trigonometrical Survey in 1841, and of a few Madras sub-assistants to the Punjab in later years, that the art of planetabling was carried to upper India.

BOMBAY

The most important of the Bombay topographical surveys were the Deccan survey started by Sutherland and Jervis's survey of the Southern Konkan.

The Deccan survey was based on triangulation extended from Garling's work to the south, and checked by occasional measured bases, but it was not of a high enough standard to maintain accuracy over so vast an area, and Shortrede's trigonometrical survey started in 1828 was intended to provide a more trustworthy basis [130–1]. Detail survey was carried out by planetable to which the general open nature of the country lent itself, and the surveyors borrowed from Madras produced unusually large outturns [125, 208].

Jervis had worked a short time with the trigonometrical survey in Great Britain, and took great pains over his triangulation and the measurement of base-lines, but he tried to cover far too large an area for the means at his disposal. He was distracted by the collection of statistics, and left the extension of triangulation and the fixing of detail largely to half-trained Indian surveyors, so that his work never reached a very high professional standard [126–7, 203 n.2]. He gives the following account of a base-line which he measured in May 1823 on a

[1] to Paton, QMG., 21–8–18 DDn. 154 (2). [2] DDn. 184 (429), 12–6–27; cf. 231 (134), 14–4–28.
[3] DDn. 231 (201), 13–11–28.

level space...on the south side of the Rutnagherry Bay. ... Having cleared and levelled it, and built up the hollows with a narrow mud and stone bank, I divided the whole length into distances of 11 chains, each 50 feet. I chose this distance because the iron rods, with which I proposed to make...final measurement, were each 22 feet long; and 25 of these would...fall somewhere near these general distances. ...

The whole was then carefully measured with the iron rods which were an inch diameter... and, these having been laid off from a brass scale...compared with the standard scale in England, ... there could be no serious error in the total length. Unfortunately both my mountain barometer and thermometer had been broken, and I was unable to get the exact amount of reduction necessary. ... The whole, however, was carefully levelled with the levelling instrument. ... The base-line was remeasured twice subsequently. ...

The ends of the base were carefully marked with two long round teak wood stakes. ... Two larger sooparee trees[1] were firmly tied with a white flag, and being high and erect they enabled me to distinguish the extremities of the base at the distance of 9 miles. ...

For the station signals I...made up flags...of different colours, and conical stands consisting of 4 poles connected at the summits with an iron ring; these, when covered with white dungaree bleached, enabled me to distinguish my trigonometrical stations at a distance. ...

On the sea-coast I could distinguish dark objects better than white; and when a point was to be fixed...close at hand, I fixed saparee trees with a quantity of grass at the top as a directing mark. ... For others more distant I made a large...cone of rough timbers, and covered it with grass. ...

The theodolite...was not very good; the limb is divided into arcs of 20′ each; the vernier again subdivided into arcs of 20″. To these arcs not being...correctly adjusted to a common centre...I impute the small differences...of distances from separate series; but a difference of 2 yards is perhaps pardonable in such distances as exceed 20,000 yards[2].

Though Jervis's survey was pronounced "highly satisfactory" by Sutherland [126], Hodgson did not think much of it;

The native sub-assistants have been employed by the Superintendent in assisting him in his trigonometrical observations, and...little or no attention has been paid to the detail. ... The detail work ought...to have held equal progress with the triangulation, and the latter only applied to the important purpose of establishing...corresponding points, from which others might be determined...by the...subordinate assistants. The multiplication of very small triangles should be avoided as causing loss of time, and leading to error [203][3].

Jervis himself was extremely satisfied with his work, and in after years held it up to the British Association as the class of survey he would like to see extended all over India, but both Everest and Waugh rated it very poor stuff, and would not accept it for the Atlas of India [127].

[1] Betel palm. [2] Journal, DDn. 182, M 194; 1823–4. [3] DDn. 220 (243), 20–7–27.

CHAPTER XV

INSTRUMENTS

Supply — Theodolites & Compasses — Sextants & Circles — Perambulators — Chains — Chronometers — Planetables — Barometers.

THOUGH surveyors' allowances had been calculated on the understanding that they provided all their own instruments, there were occasions when Government instruments were issued on loan or payment [II, 221]. It generally took at least a year to obtain instruments from England and, though they could often be purchased from dealers at the presidency towns, or from brother officers, these were not always of the pattern desired. As a matter of policy, therefore, the Military Boards[1] maintained stocks of the more common instruments at their arsenals and depots, which were generally of decidedly inferior make, supplied by contractors in England whose first thought was financial profit [II, 221–4, III, 212].

In 1815 the Madras Government ruled that military surveyors on the Quartermaster General's establishment [II, 321–2] should provide at their own expense,

The First Class, One theodolite and stand—One circumferentor and stand—One plane table on stand, complete with compass and graduated brass ruler with fiducial edge and sights—One 100 feet brass measuring chain, with 10 pickets—One case of graphical instruments, with water colours, &c., &c.

The Second Class, ... the same instruments, with the exception of the theodolite, and

The Third Class [the same] with the exception of theodolite and circumferentor.

The above instruments are...sufficient for ordinary purposes ; but when Assistants Quarter Master General shall be employed in duties requiring a superior description of surveying instruments, or a perambulator and pocket compass, the Q.M.G. of the army is authorised to supply the same, with conveyance, from the public depots ; the officers to whom they shall be entrusted being held responsible for their preservation[2].

For the similar establishment of officers in Bengal [335], the Q.M.G. was authorized to hold stocks of instruments as well as drawing paper.

For some time the Surveyor Generals had been trying to build up stocks of better class instruments at the different presidencies, sometimes by indent on the Directors, and sometimes by local purchase. On taking over duty at Madras in 1810, Mackenzie placed a small order on England for his own account, and in 1816 persuaded Government to take it over ;

Finding there was a considerable want of proper instruments adapted for survey and for drawing...I directed my agents in England to ship for me a certain number...made up by artists of character. During my absence these articles arrived and are now in hand. I beg...they may be purchased for the use of the Survey Department on payment of the prime cost, the expence of freight and insurance, &c., ... under the usual affirmation on honour [291]. They consist of 2 best theodolites, 4 small theodolites (by an artist of repute), and several other small articles, ... amounting to £227–4–0[3].

As he had now to maintain stock lists of survey instruments for the whole presidency, he asked that they should all be at his disposal ;

While the number at the...Surveyor General's Office is comparatively few, there appear to be several...dispersed at such a distance...that they could not be...resorted to for service, or sent down for repair, without loss of time. ... There are...43 perambulators, 68 brass chains, and 40 plane tables, a number that can scarcely be required for a long time to come in any department. Some of them being immediately necessary in this, ... the whole, ... excepting

[1] Comprising QMG. ; CE. ; Art. Comdr. ; Commy. Gen. ; etc. ; responsible for supplies, barracks, etc.
[2] MMC. 7–3–15. [3] MPC. 16–2–16.

those belonging to the Observatory and the Trigonometrical survey, should be deposited at, or at least reported to, this office as to their state and condition[1].

Hodgson and Webb spent a lot of money on private instruments and found transport expenses in the mountains so heavy that they got special permission to charge these in contingent bills. In 1818 Hodgson asked for the loan of

perambulators and mountain barometers. I have been already at so great a private expence for those and other instruments, that I cannot afford to purchase all I want. I have already instruments, my private property, of the value of about 12,000 rupees, and lost an assortment in a ship taken by the enemy[2], which cost me in England nearly £200 [31–2].

Perambulators are very useful in many parts of the mountains, but they are costly...and are generally rendered unserviceable in the course of 2 or 3 months, and 2 must always be run at a time [25]. All the mountain barometers sent to me from England have been broken ere I received them [33]. I should therefore be greatly obliged if 4 perambulators might be sent to me, and should any mountain barometers arrive from England unbroken, that I might be supplied with some of them, to be returned to store when no longer wanted[3].

Webb made an equally urgent request ;

My theodolite, a small but excellent instrument, with centre work, had a fall some time ago, since which time I have not been well satisfied with its performance, and it was to supply its place that...Government consented to grant me the astronomical quadrant, *which has proved unserviceable.* ... In November 1815...an order for an astronomical circle was delivered to Mr. Troughton, with half the price (£75) in advance ; but my friends in England have not yet been able to persuade that excellent, but dilatory, artist to complete his engagement.

I am desirous to return the quadrant...and, as I shall then have *no instrument of any description belonging to Government,* and have, including barometers, expended nearly £1,200 on instruments, a greater proportion of which arrived (or have since been) broken, I... request that a "portable azimuth and altitude circle" or a "repeating circle" of English construction may be supplied. ... No other...is sufficiently exact for accuracy[4].

Government issues were in small favour and Edward Garstin only applied for a level because his own was out of service

I have one of the best levelling instruments in India, ... but owing to the negligence of my servants the stand...is lost. ... As it will take a considerable time to get one made in this country, the duty on which I am now ordered would suffer a considerable delay should I be forced to wait till my instrument is repaired. ... I...make this application to have a levelling instrument lent me from the Company stores, which I will return as soon as done with. ...

Although I have the theodolite which the liberality of Government formerly gave me to replace the instrument I brought from Europe and lost on service, yet it is so very bad an instrument that it is useless, as no possible adjustment can make it correct enough to...place the smallest dependence on it [II, 223 ; III, 31][5].

Sutherland had great difficulty in getting respectable instruments for

Captains Steele, Perry, and Cunningham, who are precluded from making...progress in the survey of the Southern Mahratta country [125]...owing to the badness of the instruments in their possession. ... Some...were supplied from Madras, but they proved to be almost unserviceable, and latterly have become quite so. As a temporary expedient...they purchased at their own expense such as were procurable in the market, but...these fell far short of the number required, and were of an inferior description. ...

The instruments required...may be sent direct to Dharwar ; ... 3 theodolites ; 3 plain tables ; 3 cases of mathematical instruments.

Not one of these was available at Bombay, but Madras was able to supply the plane-tables and drawing instruments, whilst the Surveyor General at Calcutta offered theodolites, to be sent round by sea ; "the store is not rich in instruments, but they are frequently to be purchased in Calcutta"[6].

In reply to Jopp's complaint of the poor quality of instruments sent out from England, Hodgson regrets "that the instruments sent are so bad, but while the spirit of contract and job prevails so strongly at home, this will be the case" [II, 224][7].

When Hodgson took over as Surveyor General in 1821, he found that instruments indented for so long ago as 1817 were lying unclaimed in the import ware-

[1] MPC. 11-11-16 ; *Govt Gaz.* 15-1-18. [2] French. [3] DDn. 152 (30), 25-2-18. [4] DDn. 150 (53), 8-10-18 ; for description of repeating circles *v: MRAS.* I, 1822 (33–58). [5] DDn. 145 (375-8) ; BTC., 13-9-20. [6] Bo MC. 180 (6) ; 13-3-to 6-10-21. [7] DDn. 223 (38), 8-8-26.

house. He obtained sanction to take them on charge for issue to surveyors of the Q.M.G.'s establishment, or to "assistant surveyors, being European commissioned officers", but not to those on "full field allowances of a surveyor". His request for a couple of sentries to guard against "house breakers" was refused as "the chowkydars belonging to your establishment will suffice"[1].

For the revenue survey parties of the Upper Provinces [150–1] he indented for 30 plane tables of the most approved construction, complete—15 small strong theodolites of 5 inches diameter, with single telescope—30 circumferentors, or surveying compasses, of the best construction, with plain sights and tripods—15 small sextants of 4 inches radius, without stands. The instruments...are not of the expensive description...required in the geographical and astronomical branches, ... but merely such as are most useful in land revenue surveys. Though I have calculated...for fifteen surveys of the zillas...I do not expect that for a considerable time they can all be commenced [149, 151]. ...

The officer...requires instruments of a superior description, but...at his own expense. The instruments mentioned in the indent are only intended for the assistants. ...

The instruments made by Mr. Troughton are much more valuable than those...by any other maker in Europe, and though their cost may sometimes be rather more than those of inferior artists, it is well compensated by their exactness and strength, and the peculiar fitness... to the purpose for which they are intended. ... I have never seen any mountain barometers sent to India by Mr. Troughton which did not arrive in safety[2] [203–5, 221–2].

As nearly a year must elapse before the instruments...can arrive in India, I...suggest... my being allowed to purchase such as...are occasionally advertised for sale, ... [and] to purchase a few elementary books on...land surveying for...the young men in the office and at the Orphan School [360 n.5], and also a pair of 18-inch globes which are required in the office. ... The cost of the globes will be 300 rupees[3] [179].

Request for local purchase was repeated four years later ;

A large supply of colours and brushes also would be very desirable, as the consumption in the preparation of so many maps is great. The cost...is heavy when purchased of the European booksellers, but perhaps Lieutenant Wroughton would...get them in the bazars and auctions at a more reasonable rate[4].

The disposal of private surveying instruments was often a matter of financial urgency for an officer leaving India, and it was a serious blow to James Gray, of His Majesty's 41st Regiment, when Mountford refused to recommend the purchase of his best instruments because they were "on a delicate and expensive construction, better suited for private use than for the public service". Mountford relented, however, and recommended their purchase for the Great Trigonometrical Survey, at a price which Gray accepted under protest ;

You appear to have quite overlooked the great additional expense of working silver and gold above brass, and...I declare upon my honour as a gentleman that the sum...viz., one thousand pagodas[5], is considerably under prime cost. ... I am ready to sell the instruments for the price you have estimated, ... viz. 2,663 rupees, having depended upon their sale for my passage to England and, as in all probability my wife's life depends upon my going in the Caledonia, I trust you will expedite the matter as much as possible[6].

The instruments which Grant took with him to Burma in 1825 were mostly his private property recently obtained from England, and included[7]

1 eighteen-inch astronomical, and 15-inch azimuth circle [159], cast-iron stands	Sicca Rupees	2,800
1 three feet transit instrument		700
1 12-inch reflecting circle		450
1 48-inch focal length telescope for Jupiter's satellites		550
2 mountain barometers, complete		250
1 box chronometer, by Cope [218]		1,000
1 watch „ by Hare		450
1 one-hundred feet standard steel chain, for measuring a base		150

In addition...I have taken an 18-inch transit, in case there should be any difficulty ...from the nature of the country in carrying from one place to another the large 3-feet transit instrument. ... I purchased one of Mr. Carey's from Mr. Mills[8] for 450 rupees. ...

[1] DDn. 204 (316–8), 20–6 & 28–7–21. [2] BTC. 28–12–21. [3] ib. 24–4–22 (55). [4] ib. 16–3–26 (39). [5] about Rs. 3,500. [6] DDn. 200 (83), 5–6–23. [7] DDn. 216 (1), 21–6–25. [8] David Mills, watchmaker, arrd. Calcutta 1793.

The circle is the only instrument of the kind in India, excepting a smaller one in the Madras Observatory, and very inferior. The transit instrument is more common, but no one in a hundred knows how to use it, for it is to be learnt only from experience.

The whole expense I have gone to exceeds 8,000, whereas every other officer has instruments from the public stores, such as theodolites, chronometers, and, I believe, there is one transit at Arracan, but these are instruments of the second order, and are of inferior value. Moreover, if any of the instruments are lost, I shall naturally expect the Government to cover the loss. ... I shall, however, insure them as far as Rangoon, and Government will not, I presume, demur at so trifling a charge[1].

As a special case the Surveyor General asked Government to purchase these instruments and allow Grant the use of them[2].

Wilcox lost his best instruments by the sinking of his boat on the Brahmaputra [54], and the Surveyor General could not replace them for some time ;

The loss is much to be regretted, but I...hope that you are still in possession of some...that will at least give a bearing. ... I am not at present able to send up...instruments...for there are none in store and none in Calcutta. I expect, however, ... a portion of those which are now at Arakan, and they will be sent off to Goalpara as soon as they arrive[3].

Nearly two years later Wilcox received

the instruments over the hills from Silhet without any other accident than the loss of one of the screws fastening on the large level of the theodolite, but it is of little consequence. The theodolite is a very nice instrument. ...

I have thought for some time past of getting from Troughton a transit and azimuth instrument, ... one of the most generally useful, but I do not know the sum necessary to remit, ... nor do I know how to quicken that admirable artist, who I understand is sadly dilatory [212]. A list which I have just received from Mr. Thacker[4] includes a transit—maker nameless—price Rs. 500—but I knew of another which was to be disposed of when I was in Calcutta[5]. I have not anything to take the measurement off for a graticule but a warped rolling parallel ruler by Berge, nor any instrument to prolong a line but my brass parallel. Should you be able to spare a beam compass with a Gunter scale, they would prove materially useful. I lost an excellent beam compass in my bauliah[6].

I am much disappointed in drawing paper ; to make sure of having it good, I wrote to a friend to get me the freshest in Calcutta. I have paper of 1822 that you sent me.

In an accurate survey, what shall I do without a *good* circle or sextant ? Can you have the goodness to have tried that circle at Thacker's, which may be better than those sent by the Company. I must, however, fairly try the one I have[7].

Hodgson replies ;

I have not yet brought a chronometer for you, but am on the look out ; one I will lend you from the office [218]. ... Instead of sending you a large sextant as I mentioned, I will despatch by Dawk Banghy [II, 221 n.5] a small stout new one which will be more useful to you in your difficult journies. ... The reflecting circle you may retain ; if on making all adjustments you find that really bad, ... you may use it as an equal altitude instrument, as you cannot have too many reflecting instruments. ...

I will send you a marquoise scale which will serve ; ... beam compasses are not required for such small work, nor have I such to spare. ... I am glad the purchases please you, and will do all I can respecting a good chronometer the first time I go to town[8].

At Madras, Mountford asked for a *conucopula* [I, 290] to look after

the mathematical and surveying instruments. ... You are well aware of the unremitted attention which is required for their due preservation. ... Besides which, there are frequent issues and receipts...to and from the several parties...requiring care and superintendence in packing, duties which at present devolve on the officer in charge unassisted[9].

At Calcutta Mohsin Husain was engaged for charge of the instruments, whilst the Registrar, Rawdon Burke, was responsible for the stock lists. To assist safe custody the Bengal Government ordered that every article should be engraved with the Company's mark and " an indelible number corresponding with entry in his records "[10]. The Directors co-operated from England and ordered " the Company's mark to be engraved in some convenient place upon all such instruments hereafter...

[1] DDn. 216 (7), 28-6-25. [2] DDn. 204 (261), 9-9-26. [3] ib. 220 (109), 15-10-25. [4] Wm. Thacker, book-seller ; after 4 voyages to East as ship's surgeon arrd. Calcutta Jan. 1819 with license to sell books; *Ben. P. & P.* XLI (1931) (157-64). [5] DDn. 224, 18-6-27. [6] country boat. [7] DDn. 214, 9-& 28-8-27. [8] DDn. 220 (249, 253, 261), 10; 20 & 28-8-27. [9] DDn. 148 (53-60) 22-6-19. [10] BGO. 29-7-25.

constructed for our service[1]". In spite of this precaution the stock lists got into a sad mess, and Hodgson writes just before handing over in 1829 ;

In the office...are lodged various instruments, the property of Government, which it has been the custom of my predecessors to furnish to various applicants on the authority of Government, or to surveyors, ... at the Surveyor General's discretion. Regular books have been kept. ...

No settlement appears to have been made for the last ten years, although within that time the charge of the office has passed into new hands several times, nor would any demand...have now been made against me, had I not accidentally put the question to the Accountant General. ... In consequence of drawing their attention to the subject, I received one year ago an account amounting to rupees 55,924–15–6. ... I endeavoured to answer by making out a statement exhibiting on the one side the number of instruments for which I was debited, and, on the other, issues taken from the book kept by the Register[2].

Three cases of deficiency are noticed ; they are of old instruments, and when new did not amount altogether to perhaps 120 rupees value. ... Mr. Morley[3]...appeared to think a receipt voucher was required for each individual entry.

Permit me to observe on the extreme hardship...this will entail upon me ; my passage was taken under the idea that the same release would be given me as to the other Surveyors General, from whom no such documents have ever been required[4]. ... Though such vouchers can be provided in time, it...would require several months to obtain them all, separated as the parties must be, many of them perhaps dead, while I have not so many days to spare. If such a rule be enforced I cannot possibly proceed to England this season. ... A new rule is made for me, and the accounts of preceeding Surveyors General saddled on me. ...

It is only 12 days since I received a second account amounting to 24,188–10–5½ rupees, and I have in that time prepared a similar statement. ... The same objections were made to this, and I was further informed that a third account would be sent immediately, amounting to 13,169–1–3–0 rupees. ... I respectfully solicit...a release...and that if vouchers are...absolutely necessary the production of them may not be made a cause of detention against me[5].

Government gave Hodgson the discharge he asked for, but ordered that Herbert [301], should give receipt for all the instruments on charge, and take steps to procure vouchers for the full period Hodgson had held office. When Everest became Surveyor General in 1830 he raised the matter again ;

It is in contemplation to debit the Surveyor General with all the instruments belonging to the Survey Department. ... When the late Surveyor General, Lieut. Colonel Hodgson, was about to proceed to England he was involved in very great difficulties on this special account ; the various receipts and vouchers, though regularly produced, were in no wise considered adequate to exonerate him, but he was expected either to produce the instruments, or replace such as were deficient at his own cost. ...

As officers in charge of surveys are constantly liable to be removed by death or sickness, or to be called away on military duty, instances must be of frequent occurrence wherein I can have no means whatever of reclaiming from them what has been issued.

He asked that on the issue of any instrument to a surveyor a debit should be transferred from the Surveyor General to the surveyor, as was the procedure followed by the Great Trigonometrical Survey in Ireland[6].

THEODOLITES & COMPASSES

Theodolites differed enormously in design and quality ; the instruments used by the Great Trigonometrical Survey are described elsewhere [II, 251–55 ; III, 257–60]. It was almost universally accepted that any sent out by the Company's contractors would be coarse and unreliable, and any surveyor who was at all keen on his work either brought his own theodolite out from home, or tried to pick up a good one by local purchase [211]. Ravenshaw, of the Madras Engineers, who had done but little survey, was glad to sell one of his own,

upon the plan of General Roy's and Colonel Lambton's theodolite, and about half the size. It is well adapted for all the purposes of surveying, and of taking angles of elevation to the height

[1] CD to B. 90 (60), 30–4–28. [2] Burke had died suddenly 1829 [II, 352]. [3] Accountant General. [4] Both Mackenzie & Blacker had died whilst still on duty [300–1]. [5] DDn. 231 (227), 7–1–29. [6] DDn. 266 (27), 11–11–30.

of 60° altitude. ... The instrument appears to be in perfect order and well packed up. I had taken out and observed the micrometers, telescopes, etc.. Of the powers of the latter, as there was no distant object visible from...the Engineer's office, I could not judge.

The only objection to a theodolite of this construction is that it is not calculated for observing stars near zenith. ... You must have another instrument for astronomical purposes; an additional expense will be thus created and, what is...in this country more important, an increased trouble in transporting the two, in place of one, from station to station. ... If you are inclined to purchase it, I shall get it sent to my house, where I have a tolerably extended horizon—put it up there—and examine everything about it more particularly[1].

Grant writes from Gorakhpur in 1820;

I have not hitherto been able to obtain any instrument to measure accurately terrestial angles of elevation. I have, it is true, a very good theodolite, but the vernier of the vertical arch counts only to one minute, and is therefore totally unfit for small angles such as the elevation of distant mountains. ... I had ordered from England a large theodolite counting to seconds of a degree, but it could not be prepared speedily, and in lieu of it I expect...a fifteen-inch azimuth and transit instrument, and one eighteen-inch vertical circle[2].

The latter instrument arrived in time to accompany him to Burma [213], where he was obviously disappointed with it, for he writes that the "makers are not likely to rise in public estimation as astronomical instrument makers. They are infinitely behind Dollond and Carey in this respect"[3]. It was never used after Grant's death, and Everest found it in 1831

amongst the lumber of the Surveyor General's Office; an old instrument by Harris, consisting of a vertical circle of 18 inches and an azimuth circle of 15 inches diameter, which had been purchased by Government some years before from the estate of the late Captain Grant, ... but which had never been of any use—and indeed never could be—for the axis of the azimuth circle, originally too weak, had become unsoldered; the sheet brass of which the columns were formed was so thin that it yielded to the pressure of the thumb, and had been indented in diverse places, thereby causing great distortion of figures and unsteadiness. The columns were both taller than they should be, and not sufficiently tapering, so that the whole was the very type of disproportion and top-heaviness[4].

The combination of altitude and horizontal circles into one instrument was at an experimental stage and passed by various names[5]. During 1824 and 1825 the Surveyor General was allowed to purchase an altitude and azimuth circle for Rs. 2,000 and a second for over Rs. 3,000. The first had belonged to Hodgson;

An azimuth, altitude, and transit circle, 12 inches diameter, made by Troughton, and divided, the vertical circle to single seconds, the horizontal to 5″ with micrometer. It is an excellent instrument of the size[6].

He writes to Wilcox in Assam [214] that

in the second volume of the Astronomical Transactions[7] is the description of another circle by Dollond which I would prefer; it is small and strong, has two telescopes for altitude, so that one views the stars direct, the other takes it in quicksilver, a mode I practised long ago, only I had but one telescope to my altitude circle; this has 2, and you may alternate with great success. It has also an azimuth circle. I sent the description of this to your neighbour Fisher in Sylhet [51–2], who has ordered one[8].

The theodolite used by Jopp and Shortrede in the Deccan [130]

was made by Troughton & Simms, and was procured from England by Captain Jopp. The lower circle was of 18-inch diameter, and was read by three moving microscopes, the circle being fixed to the feet. It had a vertical circle of 9 inches, read by two verniers to 10″. It had some original defects, and was latterly further impaired by use—and several accidents which it met with—so as to be unfit for delicate observations[9].

Of the smaller instruments, Everest describes a six-inch theodolite which he had used for seven years, "unquestionably the best instrument of the kind with the department on account of the excellence of its telescopes"[10], and Cheape used a theodolite by Troughton divided to 20′, and reading by vernier to 20″, with two telescopes, tangent screws, etc. This...I have tried in measuring the three angles of the triangles in the Naaf River, and never found it to err more than 10″ in the sum of the angles[11].

[1] from Riddell to SG., 15-10-17; DDn. 151 (64). [2] DDn. 147 (164), 20-7-20. [3] Fdbk. DDn. 239, M 421; 1825. [4] SG. to GG. in C. 21-8-39. [5] eg. altazimuth theodolite [I, 201]; cf. Lancaster Jones. [6] DDn. 152 (69), 31-1-19 & 198 (180), 14-11-22. [7] MRAS. II, 1822. [8] to Wilcox, DDn. 220 (261), 28-8-27. [9] DDn. 518 (202), 16-9-41. [10] DDn. 171 (403), 9-9-25. [11] Report, 14-10-19; MRIO. Misc. 20-0-19.

Fisher used "a 4-inch theodolite divided to minutes, by Worthington & Adams, for the traverse, and a larger one by Watkins for fixing points by triangles"[1], and most of the revenue surveyors found a 4-inch theodolite sufficient for their needs.

For the mere running of traverses where vertical angles were not required, many surveyors preferred a good compass or circumferentor [I, 201], and Grant writes from Gorakhpur [151, 159];

The angles...were observed with one of Gilbert's newly invented surveying compasses [II, 232]. To the fly of the compass there is attached a silver metal ring, eight inches diameter, the arch of which is divided into thirds of a degree. The fly is placed in the focus of a prismatic lens that shows the line of collimation made by a wire in a sight vane, and the degrees observed. Near the sight vane there is an unsilvered speculum for reflecting the sun in order to find his azimuth, there are also two coloured glasses.

The whole is fitted in a box that turns horizontally in a conical socket. As the want of telescopes was a great objection to this instrument, I procured a two-feet achromatic, to which I attached a metal axis with two arms branching out conically like those of a transit instrument. The ends of these rested on two brass...pillars, that were screwed down to the compass box, & placed truly perpendicular to the magnetic axis.

For common surveying this instrument is better than the best theodolite. It is more convenient, requires no adjustment, and saves much time. When any great accuracy was required, an excellent theodolite was used fitted with a lens, but as the power of the telescope was not great, I often applied a two-feet refractor, which by a peculiar contrivance of the glasses, I caused to magnify 100 times[2].

Bedford also preferred a good surveying compass on a stand [161].

SEXTANTS & CIRCLES

For astronomical work quadrants were passing out of favour [I, 199–200]. Nearly every surveyor had a sextant or reflecting circle which possessed

very superior qualities over the sextant, though in principle and use it is the same as a sextant with a complete circle instead of only the arc of a circle [I, 199 ; II, 229–30]. ... Index error may be eliminated by observing forward and back. Other errors are eliminated by reading the three arms of the index round the limb. Moreover angles may be measured as far as 150 degrees ; consequently the sun's double altitude may be observed when his distance from the zenith is not less then 15 degrees[3].

Cheape used "a sextant by Troughton, about 10 inch radius, divided to 10 minutes, and reading by vernier to 10″. The observations for latitudes by sun's meridian altitude...have been found to agree to 5″[4]". Grant had a battery of

three sextants. Two, by Gilbert and Bate[5] respectively, of 8-inch radius, and one of fifteen inches...by Mr. Troughton. The sextant made by Gilbert was a nautical one, counting reflected altitude to 15 seconds. The construction was good. The telescope however, was of too small a magnifying power, and the metal expanded so much during the hot winds that no reliance could be placed upon it within one minute [178]. In cold weather it answers exceedingly well. Bates' sextant is superior being more accurately divided ; the arch also is silvered, and the telescope is in every respect superior [180].

The sextant made by that incomparable artist Mr. Troughton is of admirable construction. The arch is platina, the divisions on the nonius were into 10″, consequently in reflected altitudes into 5″. There were four achromatic telescopes of different powers. Accompanying the sextant there is an artificial horizon made by Troughton on a new construction[6].

Wilcox found his sextant had a persistent error —" Altitudes shown by it are too small in the proportion of perhaps a half second in the degree "— He was equally disappointed with a circle by Gilbert ;

I have taken lunars with it. The divisions of the verniers are excessively coarse, & the index glass appears faulty, yet I hope to do better with it when better acquainted with its errors. I should be glad to get on any terms a good angular instrument of sufficient radius. It is so excessively unpleasant to work in the dark, using approximate corrections on imperfect data. The circle...I should be happy to put on board the first boat travelling your way[7].

[1] DDn. 230 ; M 414 ; 1826. [2] Fdbk. DDn. 163 ; M 321. [3] Thuillier & Smyth (702). [4] Fdbk. MRIO. M 257. [5] Robert Bate, of 17 or 21 Poultry, London, 1808–48. [6] Fdbk. DDn. 163, M 326, 1817–9. [7] DDn. 214, 1–4–27.

Hodgson then sent him from the revenue survey stock [213],

a small stout sextant which you can easily carry, that with a stand would be a man's load. I do not use stands ; nothing can equal a human hand and the motions of the wrist ; a steady hand and quick eye are best, and practice makes perfect.

It is not astonishing that discrepancies are found among small instruments ; ... makers cannot divide so near as they pretend, nor can observers observe what they cannot see, i.e., 10″ or so. Many things may accord, and yet be all wrong, but a mean of many sights will give you all you can want for your purposes, probably the truth within 15″ in latitudes[1].

CHRONOMETERS

Cheap chronometers were easy to find, but large prices had to be paid for anything really good. Grant valued his at Rs. 1,000 and Rs. 450 [213]. For Dangerfield's trip to Cochin China [267] the Surveyor General could not

conveniently spare any. Two...are undoubtedly...necessary to the perfection of some of the scientific objects contemplated. ... Captain Dangerfield...has one...which was my private property, and purchased with other instruments by Sir John Malcolm...for...use in Malwa [84]. If the Agent to the Governor General should...purchase another...in Calcutta, where they are easily procurable, ... it would be advisable to do so[2].

Hodgson reports that Herbert was

plundered by a gang of horsemen...between Gwalior and Agra[3], notwithstanding he had a small but insufficient escort. The banditti attacked his baggage on the high road, and by day. Among other losses was that of a chronometer, his private property. I...indent...for a chronometer for him. ... An assistant surveyor on 100 Rs. a month cannot be expected to purchase such valuable instruments. When he was appointed...he was allowed several instruments from the store, but did not apply for a chronometer, having one of his own. ...

I have been at much expence in buying very valuable time-keepers ; a pair by Molineux cost me 2,400 rupees, and one by Brochbash about 90 £ sterling in England. They are my private property, but an assistant surveyor cannot afford to buy such high priced instruments. ... Two chronometers at least are necessary in carrying on difference of longitude by transference of time, but 3 make the results much surer[4].

Gerard recommended the purchase of a number of instruments from Mr. Sinclair, a merchant of Bareilly, amongst which was

a very handsome and good-going *gold* chronometer, made to order by Dubois and Wheller, inventors of the inclined motion clock, etc., Rs. 500. The chronometer, if it is good, is amazingly cheap, and I would recommend the Board to purchase it, because Mr. Blandford and I would then be able to determine differences of longitude of 50 or 60 miles by means of rockets within a single second of time [90, 189][5].

Hodgson sent up a chronometer to Wilcox at Sadiya [214] by a Mr. Bruce[6] ;

The chronometer...belongs to the office. ... I have not had opportunity to purchase one for you yet ; if I did, I could not rate it till the weather clears up. ... If I can get a good chronometer for Rs. 600 or 650 I will send you, and I think I can. The middle sized box chronometers are best ; it is of no advantage to have pocket size which cannot be carried in pocket. The trouble of carrying in hand like a basket...is the same for large or small ; very large I do not like, but sufficient room for your work is desirable.

To...send any chronometer by dawk...would be certain destruction[7].

In 1828 there was a battery of six clocks and chronometers at the Surveyor General's office, where their rates were taken regularly. The makers were—A. Barraud—B. Cope—C. Earnshaw—Parkinson & Frodsham. The chronometers which Olliver sent down for repairs were, however, passed to Gray, the watchmaker, who returned them with a detailed report of their rates[8].

PERAMBULATORS

Perambulators were still the normal means for the measurement of distance. In the hills, where they were generally supplemented by pacing or calculation from

[1] DDn. 120 (261), 28-8-27. [2] DDn. 196 (111), 5-10-21. [3] on his way back from duty with Reserve Army [34]. [4] DDn. 157 (7), 1818 & 152 (38), 1-3-18. [5] DDn. 133 (266), 18-7-18. [6] obviously C.A. Bruce, trader of Sadiya. [7] DDn. 220 (161), 28-8-27. [8] DDn. 175 (12) & 231 (294), of 5-12-29.

time [196–7], readings had to be heavily corrected for the steepness and winding of the path [II, 197–9]. Perambulators from England were expensive, and their working life a matter of a few months [212]. The old Madras pattern attributed to Pringle [I, 198–9] was still in demand, with various improvements, and Mackenzie had a number made up by the commissariat at Fort William ;

I send you the Madras model with a perambulator wheel, and, as the one you sent me turned out exactly the same measurement, I think there is no danger of the principle being mistaken, which is precisely the same as that of the common Europe perambulator, or way-wiser, which is worked by two plates of unequal dimensions, calculated for the circumference to be worked by a perpetual screw. In the small perambulator this machinery is enclosed in a box, in the manner of clock and watch work.

In this wheel the screw and plates are exposed to view, and worked by the centre of the wheel or axis. The only difference here is Mr. Brett's improvement for the lower divisions for yards [II, 228]. ... Your workmen have only to cut the plates, etc., and to follow the precise dimensions of the wheel now sent. ... Any improvement you can give to the solidity of the timber work, and its security against shrinking in the hot weather, by clamps, by oiling, by painting, etc., will be useful. One man always works it to most advantage, as I have experienced since 1788, when I first fell in with this kind. I wish much you could supply us with a few more, as they are much wanted[1].

In another letter he specified that the perambulators should be

made of mahogany, many years in seasoning since it left the West Indies. ... I never used, excepting once, any but the larger wheels, nor are any other used on the Coast [I, 143]. The people are instructed to attend particularly to their management. I had one in use 12 years —with repairs, it is true[2].

"I have got a new wheel made in Cuttack", writes Buxton,

of the exact dimensions of the old large one, and I have also a small perambulator belonging to Government, which will do for one of the lads, and...one of my own for myself, so...there will be no immediate necessity for getting Mr. Allen[3] to make up any for our survey[4].

Hodgson asked for a number to be made up for the revenue surveys ;

As those which are sent from England are of the small kind, and are very expensive, and soon rendered incapable of service, ... a sufficient supply of large sized perambulators might be...constructed in the Gun Carriage yard at Seringapatam, where...they are made in a very superior manner...suggested by Lieutenant Brett [II, 461]. ...

In 1818 the late Colonel Mackenzie received four...from the Commissary General at Madras, two of which were of Pringle's plain construction, but the other two had Lieutenant Brett's improvement. One of the latter was sent as a pattern to the arsenal in Fort William, where six were made, but I understand they were inferior to the original, though attended with double the expense having cost sicca rupees 176–12 each, while at Seringapatam and Madras... the plain wheels were generally purchased for 21½ or 25 pagodas, equal to sicca rupees 70 or 81 each ; but with Lieutenant Brett's improvement they may probably cost 90 rupees each, and the land carriage from Seringapatam to Madras, and tonnage from thence to Calcutta might amount to 120 rupees for twelve, so that the whole expense would stand...Rs. 1,200 ; if made at Calcutta they would cost Rs. 2,121. ...

I...propose that eight in addition, making in all twenty, be indented for, and the eight in excess might...be supplied to...officers...on paying the expense...and 25 per cent in addition[5].

The order was placed, and 19 were delivered to the Board of Revenue at Patna for distribution to the revenue survey parties[6]. Hodgson reports in 1826 that

they are the best...I ever saw, being strong, simple, and little liable to be put out of order. ... If every judicial and revenue officer...could be supplied with one of these perambulators, they might be occasionally well employed in making rapid measurements of boundaries. ...

The erection of mile stones on the roads connecting all large places [II, 451], might...be... politic, ... in some sort familiarizing...our measures, and shewing ...the advantage of them over ...uncertain coss. The Moghul conquerors established their coss minars, as we know, on several important roads [164–5 ; pl. 15], and so did the Nepaulese on the countries they conquered in the mountains. ... If all Judges were supplied with good perambulators, they might set up mile stones throughout their zillahs at little expense to Government[7].

[1] DDn. 154 (61), 13–1–19. [2] DDn. 156 (156–7), 10–4–19. [3] probably Peter Allen (d. 1853); arrd. 1816 ; Local Sub-Lieut. with Rocket Troop till 1822 ; Dep. Commy. ; ret. as Bt. Capt. 1837. [4] DDn. 142 (282), 21–8–20. [5] BTC. 8–5–23 (53). [6] ib. 9–7–24 (59). [7] ib. 16–3–26 (39).

Wilcox had to abandon his perambulator on the adventurous march he made with Burlton into Hkamti Long [60–3] and on his return asked for a new one as his old one had "acquired the palsy of age"[1] [II, 78].

CHAINS

The common chain of iron or brass, either of 100 or of 66 feet, was in regular use, experienced surveyors keeping a second "for the examination and correction of the other"[2]. Specially designed steel chains of superior make were sometimes ordered from England. Hodgson had

a steel chain measuring, in the temperature of 55°, one hundred feet, having brass registers for setting off the accurate length. ... Made by Troughton. ... The chain being of steel it is not liable to alter its length. ... It is necessary to have some standard measure of this kind ...wherewith to compare other and more imperfect instruments[3].

Boileau used this chain as well as a similar one of his own [26];

In addition to the chain...with loop joints, I have a very beautiful steel chain, in a box, with 2½ feet links, jointed like a watch chain, and equal to 100 feet at a temperature of 68°, but I am not aware of the exact weight required to stretch either of these chains to their proper dimensions during the process of measuring.

The flat-jointed chain was sent up to Agra by Colonel Hodgson. ... I can make use of either of them, and leave the other untouched as a standard chain, by which the quantity of elongation (if any) in the working chain may be accurately ascertained[4].

Chains were the normal means of revenue survey measurement, though Grant preferred the perambulator [159–60];

The chain requires much time, and...the error of both is equally uncertain. ... The chain requires at least three individuals, and one must keep the account of the number of chains measured; this must be done by a native, as the surveyor's attention should be occupied chiefly in sketching in the features. ... But in trusting to a classee for the accurate numbering...there is too much risk of error, and the best way...is to abandon the chain[5].

Oliver writes from Delhi;

I received six brass chains of 100 feet from the Surveyor General's Office; they did not answer so well as might have been wished. However, by taking great care to have their constantly varying lengths correctly ascertained by frequent comparisons with as accurate a standard as could be procured, they have proved very useful, although by no means so convenient as Gunter's chains [164]; an iron one of the latter description was in constant use for more than six months without...any material variation in its length. ...

The inexperience of the chainmen at first was productive of much delay and vexation but they gradually improved[6].

Hodgson, strongly recommended the distribution of reliable standard scales for checking the chains [163–4], " stoutly made...of iron or brass, and divided into feet, inches, and tenths of inches "

In land surveys either perambulators or chains may be used, and tho' the former...performs ...most rapidly when the ground is level, it has disadvantages when ditches and hollow places occur. It is also a costly instrument, and very liable to get out of order, but the Gunter's chains of 66 feet [164 n.2], tho' it requires rather longer time...is cheap and simple, and if it's length be frequently compared with a strict standard chain, gives the most satisfactory results, and...affords data for easy calculation[7].

Lambton and other surveyors had generally to rely on short brass scales as primary standards of length [II, 257; III, 249], and on the Garhwāl survey Hodgson relied on, "a standard brass scale 43 inches in length, with a vernier for subdivisions to the 1000th part of an inch, ... by Troughton"[8].

Jervis had " two brass scales, each of two feet in length ",

one by Smalchalder, the other by Carey. Captain Owen, ... employed on the survey of the African coast, and lately come to Bombay, having been furnished by the Admiralty with a

[1] DDn. 224, 18-6-27. [2] Cheape, Chittagong; Fdbk. MRIO. M 257. [3] DDn. 152 (69), 31-1-19 & 198 (180), 14-11-22. [4] DDn. 227, 10-10-29. [5] from Grant, 5-7-22; BTC. 19-6-28 (36). [6] from Oliver, 25-8-23; BTC. 19-6-29. [7] from Hodgson, 15-4-24; BTC. 7-5-24 (104). [8] DDn. 152 (69), 31-1-19.

very fine four-feet brass scale, adjusted to the latest measurements of Captain Kater, ... it was found that 2 feet on the Admiralty scale was...equal to 23·997 inches of Smalchalder's scale[1].

Lambton's "standard scale and steel bar", received after his death, were bought on Blacker's recommendation for the Surveyor General's office; "Without them... there is no standard in India to which the Government may refer any question of linear measure with sufficient confidence"[2].

PLANETABLES

Planetables made up in Madras [II, 229] were regularly used by surveyors trained at the Military Institution, and by the assistants working under them [II, 216, 229; III, 206]. Mackenzie had brought several with him to Bengal and most of the apprentices engaged for the revenue surveys received elementary training with them. Hodgson indented for a number to be sent out from England [213], but Grant did not find them a success; they were not, he writes

much used in England, and they are still worse adapted for this climate, as they are inconvenient to carry about, and require much time for adjustment in the field. ... [He preferred] taking angles with an instrument and making a rough protraction of the work on the spot, noting down the angles and distances, and sketching...objects near the line of survey [208].

Some alterations were made in the plane tables brought up by Lieutenant Wroughton but they were still found inconvenient, and were only used by the boys because no other instrument could be spared. ... Only five villages were surveyed with the plane tables. ... The boundaries were first surveyed with the circumferentor, and being afterwards traced on the plane tables, lines were drawn in different directions through the village lands to point out the course the boys should pursue[3].

In Madras, however, Montgomerie continued to press the use of the plane table in all the surveys [208–9], and ordered

15 plane tables to be constructed in the arsenal. ... An improvement appears...necessary to facilitate the taking of bearings with greater accuracy...by having a light brass frame to fit close to the outer edge of the table, accurately divided into degrees, the centre of the instrument forming the point of convergence[4].

BAROMETERS

Mention is frequently made of the great difficulty surveyors had with their barometers from the constant breakage of the glass tubes[5] [30–3, 203–5], and the valuable information they gave in spite of these difficulties. Lambton carried two barometers, but reports in 1816 that one had been rendered

useless ever since I was at Gooty in 1811. ... During the hot winds, and while standing in my tent, a quantity of air got suddenly into the tube, from what cause I never could find out. It is now empty, and I did intend boiling the mercury in the tube and try to put it right again.

Though Gerard became expert at handling barometers [204–5], Hodgson and Herbert were not so successful [33];

We now began to boil the mercury in the tube. The tube as usual broke. None but a professed artist can expect to succeed in this difficult business once in ten times. ...

The barometers I had were 2 out of 6 sent from England to the Surveyor General's office. ... So little attention had been paid to their packing that the tubes of them all were found to be broken when they arrived in Calcutta, as well as most of the thermometers belonging to them; there were spare, but unfilled, tubes sent with them, and some of these would not fit[6].

Hyde had taken delivery of this consignment in Calcutta;

The whole of the barometer tubes are unfortunately broken, but as spare ones have been forwarded with them, they can be repaired. Aware as I am of the difficulty of filling the tubes, yet I would strongly recommend...their being sent out empty, as the violent motion

[1] Journal, S. Konkan, MRIO. M 125. [2] DDn. 204 (133), 31–12–24. [3] from Grant, 5–7–22; BTC. 19–6–28 (36). [4] DDn. 202 (157), 18–7–25. [5] about 3 ft. long. [6] *As R.* XIV, 1822 (100–1): cf. DDn. 152 (2), 1–2–18.

...occasions the quicksilver almost invariably to destroy them. The thermometers attached are broken, but extra ones having been fitted in the boxes...render them still serviceable.

Being perfectly aware of the delicacy and nature of these instruments, I requested Lieut. Herbert, who...has since obtained permission to receive charge of two for the use of Captain Hodgson, to bring the six barometers in his palkee from the fort to this office, to prevent the possibility of their being injured in the carriage. They were opened by me in the presence of that gentleman; the tubes were *all broken*, and, ... with the exception of one box containing two, I am confident that the other four were never before unpacked. The quicksilver...was found loose in the boxes when examined in the arsenal by Lieut. Herbert[1].

Webb had several barometers broken, and writes to Hyde that "another barometer was sent to me by a friend a few days ago; but like all the rest, it was broken upon the road"[2].

"Mountain barometers" intended to be portable had the usual long tubes containing mercury, and were fitted with a tripod and a scale of heights in feet. Hodgson suggests that Irvine, before starting on his survey of the sources of the Narbada [88–9], should visit Calcutta

where I could give him special instructions, and explain to him...the use, and indeed the construction, of the mountain barometers. ... Having been so frequently disappointed by the breaking of the barometers sent from England at a heavy expence, Lieutenant Herbert and I turned our attention to fitting up such tubes as we could buy in Calcutta, and succeeded perfectly in making barometers sufficiently accurate for all practical purposes[3].

Wilcox writes that on his first expedition into the Mishmi Hills "my only barometer tube & two thermometers were broken before doing me any service", and on his first trip beyond the Brahmakund [58–9]

the only instruments that I carried were—a sextant and false horizon—a good compass—a Woollaston's thermometric barometer[4], and a barometer of the common kind. The Woollaston got put out of order at once, and the tube of the other lasted a very few days[5].

He had one barometer in good order for his successful trip to the Irrawaddy, and looked forward to setting it up "in the snows";

Travel up the Dihing. Barometer readings give apparent height above Calcutta, 1876 feet. ... Barometer at 3 p.m., 28″·37; Therm. 76°; elevation of Roonkoo on the bed of the Dupha, above Calcutta, 1,488 feet. Unfortunately broke two tubes in attempting to boil them.

Burlton records that on May 15th the barometer read 7,387 feet, two days before the tubes were broken, and that "the barometrical calculations have been made by me, and are not to be depended on for any great degree of accuracy"[6]. Hodgson could not replace them;

Woollaston's thermometric barometers are of no use; you cannot take them out of their case without breaking; they will not do. Besides, there are none in Calcutta; a long-scaled thermometer, say 2 feet long, might be of use, but barometers are best[7].

In a paper on obtaining heights by the boiling of water, James Prinsep writes;

Woollaston's apparatus is beautiful in a laboratory, where it shows minute variations; but for rough work out of doors, accuracy must in some measure be sacrificed to strength and portability. Captain Herbert provided himself from England with ordinary thermometers divided from 180° upwards to tenths of degrees; half a division thus represented about 25 feet, which in most cases is ample[8].

Hodgson writes to Pemberton, away in Manipur;

I went into town yesterday, and bought for you 3 barometers; one a mountain stick one (apparently very perfect) for 50 Rs.; another of the kind...that you have; one with the sliding index and tube leading from the tripod, a very good construction, as you see the whole length of the tube; it has three tubes and a case; they wanted 100 Rs. but I got it for 80. I will also fill and boil a stout barometer of my own, and lend it to you, so you will be complete.

We had a deluge of rain on the 20th, 5½ inches in 9 hours, more than I remember in the same time; to-day is clear and pleasant, ... but it is a sorry climate. Pray send me an order for 130 Rs. 2 as. for the barometer and cooly hire[9].

The aneroid barometer, working on an entirely different principle, without any column of mercury, was invented in France about 1843.

[1] DDn. 131 (9), 10–1–17; (14), 24–1–17. [2] MRIO. M 575, 3–4–17. [3] DDn. 198 (1), 3–4–22. [4] an apparatus "for measuring altitudes" exhibited to RS. by Rev. F. J. H. Wollaston (1762–1823), *DNB.*, *Phil Trans.* CVII, 1817 (183–96). [5] *As R.* XVII (365). [6] Journal, DDn. 214; to SG. 4–7–27. [7] DDn. 220 (261), 28–8–27. [8] *JASB.* II, 1833 (197). [9] Calcutta 22–9–27; DDn. 220 (278).

CHAPTER XVI

GREAT TRIGONOMETRICAL SURVEY, 1815–23

De Penning & Lawrence, 1815–7 — Transfer to Supreme Government, 1818 — Arrival of Everest, 1818–9 — Everest's first task, 1819–20 — Advance to Berār, 1821–2 — Everest's Western Branch, 1822–3 — Passing of Lambton, 1823 — Computations & Reports.

LAMBTON spent the first three months of 1815 in closing the Gooty–Bīdar section of his great central arc, measuring a base-line at Bīdar[1], and taking astronomical observations at Damargida about 20 miles to the north-east [II, 249 ; III, pl. 18]. He then returned to Hyderābād where he spent the next six years working on reports and computations [237–9].

His staff at this time comprised four assistants, De Penning, Lawrence, Olliver, and Rossenrode, who were all fully employed on indoor work till after the rains of 1816, when Lawrence connected the Bīdar base with the neighbouring stations to the north[2]. No further extension was immediately possible owing to the unsettled state of the country, but, though Everest attributes the long delay to *pindāri* raids[3] [96, 115], Mackenzie writes of the Directors' urge for economy after the expenses of the Nepāl War ;

I regret exceedingly that you have been obliged to lay by this season, as the orders from Europe are so peremptory for a reduction of expense. ... At Bombay the Surveyor Genl.'s Department was laid by, & in Bengal also the office is in charge of an assistant till I get round. The salary here has properly ceased since May last year[4].

Lambton himself did not regret the delay, for

field work has got ahead of indoor work ; indeed I am not sure that I shall be able for another excursion till after the hot weather in 1817. My report would have been furnished in 1815 had it not been for the expediency of extending my meridional arc as high as 18° and upwards. ... The Court of Directors...recommended that I should state the probable time for the completion of my work [II, 249]. ... I have allowed ample time ; that is to say, three years in the Nizam's country, and four in connecting Masulipatam with Point Palmyras [99, 226, 233], and I hope to make a trip to England in the meantime.

If the Pindaries are not checked in their incursions it will be impossible to go out in the cool season, and the only time will be from June to the middle of October. I wish much to get as high as 21°, or at any rate to 20°, which will reach the range of ghauts. That, with a little branching out, will lay an ample foundation for the detached surveys which may be extended from thence over every part of the Dekkan[5].

In 1817, therefore, as soon as the rains had cleared the air for observations [8, 229, 235–6], De Penning was sent out to extend the arc from Damargida to north of the Godāvari, and his journal is still preserved [II, 247 n.4].

15th August 1817. The Resident had been occupied by the visit of the Commander-in-Chief[6]. I had received instructions to extend the meridional series...up to Nandair. ... From Nandair I am to extend a series of triangles in an easterly direction along the S. bank of the Godavery to Nirmul, ... and then return direct S. to Hyderabad with the triangles, endeavouring to intersect Eilgundel on the way [pl. 18].

Besides a part of the Survey escort, and his [Lambton's] lascars, a party from the minister of the Nizam's Government was attached to us for procuring supplies and aiding us in fixing our flags. ... I left the French Gardens [II, 394 n.1] on the 15th...after four o'clock in the afternoon, leaving my family to the protection of God. ...

[1] 75 m. NW. of Hyderābād. [2] DDn. 171 (359), 5–9–25. [3] Geo. Everest (4) ; *GTS.* I (iv–v, A). [4] to Lambton, 3–5–16 ; DDn. 156, (35–6). [5] to Mackenzie DDn. 62 (140), 11–5–16. [6] Thos. Hislop, to discuss co-operation of Nizām's forces against *pindāris.*

19th. Having to despatch flags to the northward for continuing the meridional series of triangles which is to commence at this station (Daumargidda), I rode to the station taking the instrument & flag people with me. I found the chunam[1] platform much injured, tho' the large stone that was fixed in the centre does not appear to have been touched. After directing the flags to different stations, returned to my tents. ...

23rd. Marched to Sauchapilly. ... We here learned from one of our flag coolies, who had just joined us from the flag he had placed near Kowlass [pl. 18], that we had observed a wrong object while at Daumargidda station, in consequence of which I was obliged to direct Mr. Olliver to proceed to the Kowlass stn., & fix the flag in its proper position, while I prepared to go all the way back to Daumargidda to observe the angle.

After three days of heavy rain De Penning got back to camp, and Olliver came in about an hour after. ... From the intelligence he brought in I had occasion to rejoice that I had undertaken this fatiguing trip, for, tho' the first error...was mine, having...mistaken a tree for a flag, ... the flag cooly, a new hand, ... was so stupid as to move the flag to another spot, ... so that had I even observed the flag right when I was first at Daumargidda, the flag being removed afterwards would have been the source of endless trouble.

They had many interruptions from rain and great trouble in procuring guides, every village closing the gate in the 'sett fence' as soon as strangers were seen approaching, possibly a precaution against *pindāris*.

5th September. Arrive at the banks of the Manjira River about 10 o'clock, and it was 7 o'clock at night when the last of our baggage got over. ...

10th. I ascended the peak this morning after breakfast and, fixing a new station on the summit in the direction of the Kowlass station, I observed a few angles and, after fixing a mark over the new station, descended the hill and returned to camp. While we were on the summit observing angles, a tyger made a spring on the cattle that were grazing below, and siezed a heifer, but the people attending the cattle by making a loud noise & shouting made the tyger quit his prize, but the heifer was killed.

Then followed constant rain day after day, with occasional intervals of clear visibility. To Lambton's distress De Penning had gone out without the vertical circle of his theodolite, so could take no angles for height[2]. The journal continues ;

21st September. ... Distant view of the junction of the Manjira and Godaveri rivers with the country under wide floods. ... 28th. ... Difficulty in securing boats for the passage of the Manjira ; ... the boat requires one hour and a half to perform one trip. ... 30th. Find a detachment of our army, or the staff of the Commander-in-Chief, at Mudnoor. ...

16th October 1817. ... Great difficulty in finding ground for suitable triangles in the region of Malligong, Olliver reconnoitring in advance. ... 24th. Marched to Nandair, crossing the Godavery. ... 29th. Marched to Kundakoortu, recrossing the Godavery near Bailoor at the junction of the Manjira. ...

6th November. Received a message from...amildar of Aurmoor, signifying his intention to pay me a visit, as he had received orders to deliver me a letter from Lt. Colonel Lambton. ... The purport of his visit was to deliver me the letter, and money, 582 pagodas, which was done with great formality. ...

7th December. Violent attack of fever. ... I proceeded to the station...but so bad as to be unable to stand, I laid myself down under the shade of a rock, & it was upwards of an hour before I recovered sufficient strength to look around me. Having fixed upon a hill for the next station, I returned to the tents with a violent fever. ...

8th. Confined to my bed, very weak, and drinking bark [II, 360]. Directed Mr. Olliver to take a few angles. ... 9th. Having no fever this day, I ascended the hill after breakfast, where I was employed the whole day observing angles. ...

14th. Marched to Secuderpoor, Mr. Olliver reconnoitring in advance. ...

22nd. Halt at Peepergutt till 3 in the afternoon, in order to bring up part of the field work, when we struck tents and marched into the French Gardens, where we arrived at 7 o'clock in the evening. On my arrival I had the mortification to learn that my old companion & fellow labourer, Mr. Lawrence, had incurred the displeasure of Colonel Lambton, and was under orders to proceed to Madras with the New Year [379]. Our department being also to be transferred to the Bengal establishment on the 1st January 1818 [I, 225].

We now describe the circumstances under which the survey was transferred from the control of the Madras Government to that of the Supreme Government at Bengal, and became the Great Trigonometrical Survey of India.

[1] lime. [2] DDn. 63 (495), 19-9-17. Both De Penning and Lawrence worked with an 18-inch theodolite only [259].

So long ago as 1807 Lambton had suggested that his survey should come under the immediate direction of the supreme government, but, though Petrie, acting Governor at Madras, supported the proposal, nothing had come of it [II, 304]. Lambton had pointed out that the time would come for his survey to reach beyond

the Presidency of Fort St. George. ... The expedience of this has frequently occurred to me; and...in a conversation with the Right Honorable Lord Minto while he was at Madras[1] this subject was particularly mentioned, when his Lordship entirely acquiesced. ... While I submit this subject for consideration, I...acknowledge the liberality of the Government of Fort St. George for their uniform support[2] [II, 414].

He raised the question again in 1817, together with a request for a professional assistant, and a medical officer, to act as geologist as well as doctor. He was himself well over sixty years of age.

The Governor General, Lord Moira[3], warmly accepted the proposal, and issued orders in a despatch dated 25th October 1817 [307]. The transfer was to take place from the 1st January 1818, and the survey was to be designated *The Great Trigonometrical Survey*, with Lambton as superintendent, George Everest as chief assistant, and a Dr. Ross as geologist and surgeon[4]. Dr. Voysey was afterwards appointed in default of Ross. Lord Moira wrote from his field headquarters up-country[5], where he was directing military operations against the Marāthas in his capacity as Commander-in-Chief, and his despatch shows keen appreciation of the importance of the survey and of Lambton's talents;

The arrival of Colonel Mackenzie in Bengal [300], and the consequent assumption by that distinguished officer of the important functions of his situation, have now carried into full effect the wise measures prescribed by the Hon'ble Court of Directors for consolidating the survey departments of the several Presidencies under one Chief, responsible only to the Supreme Government of India [II, 396–7].

This...has naturally led...the Govr. Genl. to...a question intimately connected with...the Department of General Survey, and I...now...communicate...the result of his Lordship's reflections on the conduct and progress of the Grand Trigonometrical Survey of India. ...

Independently of the benefits reaped...from labours like Lt. Coll. Lambton's in regard to the more accurate knowledge of the figure of the earth, ... the most important practical advantages must obviously accrue from the prosecution of this trigonometrical survey. ...

There is no other solid basis on which accurate geography can so well be founded. The primary triangles thus spread over this vast country establish almost beyond error a multitude of points, and the spaces, ... when filled up by the details of subordinate surveyors, will afford... a map without a parallel. ... The Govr. Genl. ventures to speak to this point with no ordinary confidence because it came under his personal knowledge when he had the honor of presiding over the Royal Ordnance Department[6]. ...

His Lordship is persuaded that its operations will...be greatly facilitated by this measure, for they have already passed the British boundary into the territories of His Highness the Nizam, and...will now progressively advance into Hindoostan and the east, until the net of triangles shall be woven over the whole continent of India. ... An undertaking of such national importance...is only in its appropriate place...under the direct orders...of the supreme authority[7].

A copy was sent to Lambton with the Governor General's hope that

the arrangements...will conduce to the general benefit of science, & to the facilitation of your operations. ... But His Lordship...derives a further pleasure from the impression that the arrangement will be personally gratifying to yourself. ... He had no hesitation in complying with your reasonable wish[8] to have an assistant & a scientific medical man attached to your department. His Lordship has every reason to believe that you will find his selection of the individuals named...to have been judicious.

Lambton asked for orders as to his future programme;

In view of the extensive field which is now laid open to me, there is such a choice...as to render it difficult to decide where I should begin, and what ought to be done. ...

The first part of the work, whenever it may be practicable, will unquestionably be that of extending the meridional series of triangles through as great an extent of country as

[1] investigating causes of Vellore mutiny [II, 290 n.4]. [2] MPC. 10-11-07. [3] cr. Marquis Hastings 1817. [4] probably John Ross, MD. *v.* Bio. Notes. [5] Shergarh, 54 E/9, on the Jumna; despatch addressed to the Vice-Presdt. at Ft. William. [6] Master of the Ordnance, 1806–7. [7] BMC. 25-11-17 (1); DDn. 142 (227). [8] Lambton's letter has not been found.

possible. ... A continuation of the same arc through 9° 2′ 40″ more[1] would extend to...nearly the latitude of Agra; and if the country should be favourable and free from hostility it would not require more than four years to perform that work. ... The general disposition of the inhabitants must be favourable, as much depends on them. ...

A measurement of such an extent would far surpass anything of the kind that either has been, or ever can be, performed in any other part of the globe, and it would be the foundation of Indian geography. ... If the maps are at all correct, this arc would pass near Ellichpoor and Hussainabad, through the middle of Scindia's territories, and terminate not far from Agra.

He then discussed alternative schemes in case it was impossible to continue his arc direct to Agra—either taking a meridian line north from Nāgpur—or making the Narbada the northern limit of a wide network of triangles extended east and west beyond the Nizām's territories.

But all this would require more hands and more instruments. I shall, therefore, confine my views to what I think may be done by myself and my immediate successor. Should I continue to enjoy that good health and sound constitution which I have hitherto been blessed with, ... I hope I shall at least see a foundation laid for a complete survey of the Deckan, if not a connection between the southern peninsula and the upper provinces of Hindoostan. ...

When I am joined by my assistant, I shall be able to send out a party during the favourable season[2] which will be employed chiefly in branching out, and in finishing more completely the belt of triangles between the Ceded Districts and Hyderabad.

When I move, which will not be for some time to come, I shall continue the meridional triangles as high as 21° 6′ of latitude, where I shall have to measure another base, and make a course of astronomical observations[3].

The Vice President replied with caution that he relied

with implicit confidence on your talents and judgment [and] trusts that you will push with the least practical delay to the greatest extent of which your present means...will admit. ... With reference to your proposition for extending your triangles by three different branches to the river Nerbudda, ... you will...furnish an estimate of the probable time and expense. ... Your proposition for the farther extension...to Agra, and afterwards from Goa to Bombay, and onwards without limit, does not appear to press for immediate consideration[4].

Lambton interpreted this as limiting him to the Deccan, and particularly to the Nizām's territories. In an earlier letter the Governor General had asked him to provide the Resident at Hyderābād with "the most accurate and detailed geographical information regarding the Nizām's territories which may be attainable", a welcome request, for he had written in 1815 that,

had I not been anxious to carry these operations through the Circars, ... I should have considered the extending of this survey over the whole of the Nizam's Dominions, ... for in all the countries that I have been in it is the most erroneous in its geography. Hyderabad, which we have been stationed at for years, is out no less than eleven minutes in latitude, and upwards of *thirty* in longitude[5] [278 pl. 17 n.].

Though disappointed, as was Mackenzie also, at the dropping of the ambitious plan for a series along the east coast [223, 233][6], Lambton decided to extend his network of triangles to the eastern borders of the Nizām's territories between the Kistna and Godāvari, and to carry the great arc northwards;

I should consider Ellichpoor, or the range of mountains immediately to the north of it, to be the limits of the survey in a northern direction. ... It will not be far from Ellichpoor, if the maps are right, that I shall next observe the stars and measure a base-line, a part of the work indispensably necessary on the score of general science [II, 250]. ...

The chief object in being in haste with it is to secure the completion of a measurement on the meridian which in amplitude will exceed the three most important and accurate ones (leaving out that of Colonel Mudge[7]) that have ever been executed, viz., that connecting the observatory of Greenwich and Dunkirk by General Roy and the French academies[8]—that between Dunkirk and...Barcelona by De Lambre and Mechain[9]—and the continuation...to...the Balearic Islands by Ms. Biot and Arago[10] [179 n.3, 237].

These Indian operations are now become of much interest to the most eminent philosphers in Europe and, although the great call for geographical information within the limits of the

[1] Cape Comorin to Bīdar being 9° 53′ 26″. [2] the rains [235–6]. [3] to Supreme Govt. 1–1–18; DDn. 92 (20). [4] DDn. 64 (72) & 133 (63), 24–4–18. [5] DDn. 63 (363), 24–6–15. [6] GTS. XII, Appx. (45); TS. V (4); DDn. 156 (134). 16–7–17. [7] Wm. Mudge (1762–1820); RA.; Director Ordnance Svy. of Great Britain, 1798–1820. [8] 1788; Roy, Cassini, Legendre & Mechain. [9] 1792–1801. [10] 1806–7; Gore (139–4); *Service Géographique* (11–14).

Dekhan may prevent at this time a continuation of the grand arc to the northern provinces, yet...when it shall be carried to the latitude of 21° 6′, and the results continue to be favorable, they will afford entire satisfaction as to...the magnitude and figure of our planet, the two great objects of modern investigation [II, 250; III, 238][1].

The extension of the arc had to wait another three years, but the arrival of George Everest allowed of good progress on the remainder of the programme.

ARRIVAL OF EVEREST, 1818–9

As Lambton was fully occupied with indoor work throughout 1818, and Everest did not join until the end of December, De Penning was sent out to complete triangulation to the south of Hyderābād, and make good connection with the Ceded Districts [II, 246–8 ; pl. 16]. After a month's work in February, he and Olliver finished this task later in the year, joining the rest of the establishment on computations from March to October.

9th February 1818. In order to connect my late operations [223–4] with the triangles brought up to Hyderabad by Lt-Colonel Lambton in 1814 [II, 249] I...set out again before the hot weather commenced. ... I left Hyderabad on 9th February, and marched to Bourampett ...to commence, nearly 17 miles from the French Gardens in north westerly direction. ...

19th. Marched to Gunganpand on the great road to Hyderabad from Kurnool, ... it is about 8 miles S. from the city & 12 from the cantonments. ... 21st. We took a few observations this morning before breakfast, and returned to the village. After breakfast we struck tents and returned to the French Gardens.

3rd November. I received orders to...take the field on the 24th October, but various circumstances occurred to delay my departure till the 3rd November. ... 6th. Ascended the hill at Gulpilly with the instrument; sent out flags previously to two stations before us. ...

13th. At Murricul we met with great opposition from the villagers who assembled in numbers at the entrance, armed, and absolutely refused to furnish us with coolies. The hircarrah & peons sent beforehand with the flag were rudely treated. After a long altercation we procured a guide and pushed on to Nabobpett. 14th. Marched to Baudapully [pl. 18]. Crossed the great gun road leading to Hyderabad from Adoni by Palmoor. ... Having a flag on the Baudapully hill, I ascended the hill immediately after breakfast, having had a short march. ...

28th. ... Yellaconda [II, pl. 16]. There is a rock south of the village where I had a flag, and which was also station of Col. Lambton in 1814 [II, 249]. Ascended the rock in the afternoon with the instrument, and the evening being favorable I finished my observations. ... 30th. ... Yellaul, on the banks of the Kistna, in the Province of Kurnool[2].

1st December 1818. Reached the summit of the Piddagoora Hill at 2 o'clock, one of Col. L's stations established in 1812, when Mr. Lawrence was employed in carrying the principal triangles across the Nulla-Mulla mountains[3] [II, 246]. The great platform that was raised for the station bulged out, forming a rude heap of stones. The rebuilding of the platform and clearing the jungle, which had grown to a good height since the last clearing, kept me employed this day and the day following.

The connection completed, De Penning returned to Hyderābād before Christmas.

On the 26th December Everest reported at Hyderābād, having marched down from Mirzāpur, through Jubbulpore and Nāgpur, and

a few days after my arrival, the Lieutenant-Colonel, with the greater part of his establishment, took the field, in order that he might satisfy himself as to my qualifications, and afford me any practical hints that might be needed[4].

This was the first time that Lambton had taken the field since March 1815, and was solely for the purpose of instructing his new assistant. They left Hyderābād on 8th January 1819[5], and observed from three stations of the great arc near Bīdar, more than 70 miles north-west of Hyderābād. Everest was delighted at seeing

this great and extraordinary man in the very scene and character in which the imagination of my early youth had learned to depict him. ... When he aroused himself for the purpose of adjusting the great theodolite, he seemed like Ulysses shaking off his rags; his native energy appeared to rise superior to all infirmities; his eye shone with the lustre, his limbs moved with the vigor, of full manhood. ...

[1] DDn. 144 (195), 22–7–18. [2] Most of these place names can be identified on modern maps, 56, H, K, L. [3] 57 I/NE & M/NW. [4] Geo. Everest (4). [5] letter from Everest, 7–1–19 ; DDn. 154 (57–9).

He left me in full control of the camp in January 1819, to return to Hyderabad; and this was the last occasion of his ever taking part in the work of triangulation[1].

After closing the last gap in the network west of the city, Everest got back to Hyderābād early in April, accompanied by Dr. Voysey[2], and prepared to set out on triangulation to the east. This, as Lambton explains, was to be based on the

meridian lines...whose positions were fixed in an early state of the survey, when I first crossed the peninsula from Fort St. George to Mangalore [II, 238-41]. The object of these meridians is to compute the latitudes and longitudes of places from the triangular measurements. They have served for that purpose for the whole peninsula, and may be continued to the northward without limits [II, 259 n.2; pl. 16].

Within the Nizam's Dominion I have already completed the country lying between the meridians of Savendroog, nearly, and the meridian of Yerracondah to the eastward, and bounded to the northward by the Goodavery, ... so as to take in Nandair and Nirmal.

I am now about to extend...eastward, and carry up a series of triangles from the Ceded Districts to the Goodavery, depending on the meridian of Kylasghur. But finding...it...impossible ...to cover up the country with an entire net, I must be contented to run up the several meridian lines...leaving the intervals...to be filled up by common surveys[3] [pl. 18].

This then was the task on which Everest was now employed;

As circumstances prevented the present continuation of the great arc, the next object was to bring up the geographical meridians of Kylasghur and Karangoolee, ... to the eastward of Hydrabad. Colonel Lambton was exceedingly desirous to continue...these to the Godavery, not only with a view to laying down the course of that important river, but because errors of uncommon magnitude were known to exist in the situations of some towns of political importance, and others of great interest, as...Warangal, the ancient capital. ...

On my return to headquarters...little respite was allowed to us, and we had speedily to prepare to take the field, ... which we did early in June. ... My instructions[4] were to carry a series eastward to meet the meridian of Karangoolee; then to run southward to meet the series of that meridian where it had been left off...on the south bank of the Kistna river; then... northerly to meet the Godavery; and lastly to run down the Kylasghur meridian, to meet the former points on the Kistna; whereby...a net of triangles, almost unbroken, would be thrown over the whole tract between the Godavery and Kistna[5].

Having started Everest off with Voysey, Olliver, and Rossenrode, and leaving De Penning in charge of the office, Lambton set out for Calcutta, where "a certain private business requires my presence"[6]. He was moreover glad of the opportunity to discuss official matters with Mackenzie and Government, and Everest states that "he had gone to make some arrangements respecting the future progress of the great meridional arc [324-5]; but, not having succeeded to his wishes, he returned in the month of April 1820"[7]. There is no record of what these "arrangements" may have been, but Lambton prolonged his stay in an unsuccessful endeavour to settle questions regarding accounts, the strength of his establishment, and their rates of pay and terms of service on transfer from Madras [379];

The necessity of my...return to Hyderabad by the ship which may touch at Masulipatam induces me once again to address the Most Noble the Governor General in Council with the hope that such paragraphs in my letter dated the 27th November 1817 [324, 379], which are the immediate cause of my remaining here, may be taken into consideration, as well as the subject of my letter dated the 28th October last [325]. The paragraphs...relate to the augmentation of my escort, and the contingent expences, ... and, as an indulgence to the sub-assistants, I...hope that whatever may be the increase of their pay it may commence at the same time. ...

If the subjects can with propriety be decided upon...I shall then...get all my accounts settled, and...return to Hyderabad, where my presence will be much wanted to make further arrangements for carrying on the survey. ... Otherwise I must detained here till the opportunity be lost for reaching Hyderabad before the hot winds set in, during which season no party can keep the field. Indeed it will be impossible for me to leave Calcutta till all my money matters are adjusted, ... when I can be authorized to draw upon the subtreasurer for the amount of my monthly abstracts. ... Impediments like these militate very seriously with the prosecution of the Trigonometrical Survey of India[8].

He wrote officially to Mackenzie describing his plans;

[1] Geo. Everest (4-5). [2] joined 15-12-18. [3] DDn. 144 (293), 24-5-19. [4] DDn 92 (90-2) 1-6-19. [5] Geo. Everest (5-6). [6] DDn. 92 (93), 8-6-19. [7] Geo. Everest (21). [8] to Public Dept., DDn. 144 (447-9), 17-11-19.

Since my being placed under the orders of the Supreme Government, circumstances have so altered, and the acquisition of territory become so great [1 ; pl. 1], that my arrangements have necessarily been changed, and my view are now directed towards the northward ; and my intention is to extend the triangles upon different meridian lines [226]...through the Deckan, and ultimately in a partial manner through Hindoostan. ...

I need not...state to you the necessity and utility of laying a correct geometrical basis... for detached surveys, and for fixing the geographical positions of every place of importance that comes within the range of the triangles. But as to the duration of a work which may be indefinitely extended it will be impossible to fix any assigned time[1].

EVEREST'S FIRST TASK, 1819–20[2]

Everest has left a dramatic account of his first season in the field, painting in vivid colours the adventures he encountered during the height of the monsoon, working through thick forest and across swollen rivers, and being finally overwhelmed with malaria. He settled his first trouble, the defiance of the local escort provided by the State, by a firm display of force[3].

It would have been a happy circumstance if all the other obstructions could have been as easily surmounted ; but the rainy season set in with more than usual violence...the very day of my reaching my first station, and torrents of rain were such that the rivers, which but a few days before were parched up to vanishing, now became swollen into mighty streams, overwhelming all impediments, and cutting off all communication from bank to bank.

There is a stream near Hydrabad called the Moosee, which falls into the Kistna below the ferry...by which I had intended to pass to the station of Sarangapullee[4] [pl. 18], ... the Moosee being at ordinary times barely ankle-deep. ... I had ordered...the supplies for my camp to be prepared at a village on the southern bank ; but when...I reached the crossing I found this rivulet, so insignificant at Hyderabad, now filled to overflowing, carrying away trees and other floating objects in its foaming current.

Thus cut off from all communication with the provisions which had been prepared for my followers, ... I learned...that there was about fifteen miles distant a place called Kompullee, below the confluence of the Moosee and Kistna, where there used to be a ferry-boat. ... By the following evening the camp was transferred to Kompullee, where we once again had abundance to eat ; and, having turned the flank of the Moosee, had at last attained the north bank of the Kistna which, pouring down over a bed of rocks shelving and dipping at all angles, was really a formidable obstacle.

As it was of great importance that my carriage-cattle should be conveyed to the opposite side, I had my elephants brought to the water's edge ; but neither caresses nor menaces could induce them to try the passage. Probably it was fortunate that they did not make the attempt ; for these powerful animals, though more at home in the water, perhaps, than any other quadrupeds, are from the size of their limbs...in need of what sailors term sea-room, and in a river which, like the Kistna, abounds with rocks...were very liable to receive some serious injury, of which their natural sagacity rendered them peculiarly apprehensive.

The boat which was to convey me and my party across this roaring and angry flood was put into the hands of the cobblers to...undergo the necessary repairs, for it was an old, and crazy, and leaky vessel, which had for some time been laid up high and dry ; but now, when no alternative was left, but either to await the subsidence of the flood, or to trust ourselves to this frail craft, I found that there was no...reluctance on the part of my people to risk their persons. ...

The boat, or leathern basket, contained about six persons, with a proportion of dead weight ; so, having reduced the baggage and followers to the smallest possible quantity sufficient to carry the instrument (an eighteen-inch theodolite), my little party embarked, and in three journeys which, as it required to undergo repairs after each, occupied till nightfall, the vessel had conveyed to the southern bank all whom I intended should accompany me. ...

I left the camp, with tents, cattle, &c., under charge of Mr. Voysey, with directions to proceed onwards to Polichintah along the north bank, and await my arrival there ; and, as the station-flag of Sarangapullee was in sight about twelve miles off, and in appearance hardly two, ... attended by one of the sub-assistants[5], and after some hours toiling over rocks and through jungle, I reached it just as the setting sun was shedding its last rays on the horizon.

[1] DDn. 62 (144), 18–10–19. [2] disregarding work of Jan. to April, 1819. [3] *v.* Bio. Notes. [4] 2 m. S. of Kistna long. 79° 46′ E. [5] Olliver or Rossenrode.

Thus separated from my baggage, and without shelter against the inclemencies of the weather, I learned to know what an Indian climate must be to the houseless European. The sky had during the day been bright and cloudless beyond compare; but shortly before sunset black threatening clouds began to grow together into a frowning mass; and at last, when all their batteries were in order, a tremendous crash of thunder burst forth and, as if all heaven was converted into one vast showerbath, the vertical rain poured down in large round drops upon the devoted spot of Sarangapullee.

I had procured a charpaee (a rude bedstead or litter) from a village about five miles off and, having bent down the branches of a young tree and covered them with rice straw, I had hoped by the assistance of an umbrella to protect myself against the effects of the storm; but, on waking in the morning, I found that I had been lying all night with my clothes soaked through; and yet, so sound had been my sleep from fatigue, that I had been totally unconscious of the circumstance.

The observations were all finished to the south of the Kistna in five days of very hard and laborious work, and I then recrossed at one of the established ferries near Polichintah, and proceeded with my operations as before.

It would be monotonous and tiresome to proceed with such a detail as this, for I have selected one instance among many, only to shew what the hardships and severities are which a person engaged in the Great Trigonometrical Survey of India then had to encounter. ...

From the station of Kundagutt [pl. 18] which I had visited previously to crossing the Kistna, I sought for a station to the east of Hydershahipett and the only eminence which offered itself was a long black-coloured range, strongly resembling in shape the back of an elephant. There seemed to be on this two places about sixty miles off, which bade fair to answer my purpose, and I accordingly despatched four of my most skilful flagmen, with an efficient guard, to seek these spots out, and occupy them with my signals.

It took me about three weeks to run southward along one side of the series, and to return northward by the other side to Hydershahipett. Nothing whatever having been heard of my detached parties, great apprehensions were entertained by me for their safety; but at last a gap began to break open in the black mountain, ... and after a fortnight's further waiting I had sufficient daylight behind to distinguish the colours of the Great Trigonometrical Survey flying on the one spot, and a signal mark on the other. The secret of the delay now came out. The station of Hydershahipett was on the very verge of the great forests of teak and ebony, far into the depths of which was situated this elephant mountain, called Punch Pándol. The access to it was by a circuitous route, unknown to any but the few straggling natives who lived in those forests, in a state closely bordering on savage life.

The nearest village was Poomrarum, about five miles from the summit, from which it was necessary to cut a road for the instruments and tents; ... and how my unfortunate flag-men could have had perseverence enough to go through with such a task, how they could have coaxed any uninterested persons to accompany them: how, after having pierced through a forest of teak trees, seventy, eighty, and even ninety feet high, thickly set with underwood, and infested with...tigers and boa-constrictors, without water or provisions, and with the jungle fever staring them in the face, they could have wandered through such a wilderness until they selected the most commanding point for a station, utterly...passes my comprehension.

But, when I visited the site of this station in the early part of the month of September, and saw the dreadful wilderness by which I was surrounded; when I saw how, by means of conciliating treatment and prompt payment, my people had managed to collect a sufficient body of hatchet-men to clear away every tree that in the least obstructed the horizon over a surface of nearly a square mile; ... then I learned to appreciate the excellent management of Colonel Lambton, who had been enabled to train up so faithful body of men, that at his command they would place themselves under a perfect stranger, and perform this dangerous duty as zealously and unhesitatingly as if he had himself been present [396]. ...

I was now far advanced into this *terra incognita*; ... to the eastward and northward no sign of humanity could be seen. Yet it was necessary to pierce far deeper into the forest to meet the Godavery, and, having fixed on a station which I judged would suit me, I sent out a party to occupy it. Day after day having elapsed without hearing of them, I detached a second party, and some days afterwards a third under one of my sub-assistants[1], but still no progress was made. At last came a melancholy letter from my sub-assistant, telling me that he was ill and going to die; and then, as a last resort, I despatched my principal sub-assistant, Mr. Joseph Olliver, my pupil since I had joined the survey[2], my right arm as it were, ... and to my great delight I at last saw my flag flying on the selected hill, and received written

[1] Rossenrode. [2] Surely the position was the reverse? Olliver had joined the survey under Kater in 1804.

intelligence of the name of the nearest hamlet (Yellapooram) [pl. 18], of its being favorably adapted as a station, and of the fate of my former parties, many of whom began to suffer from the effects of the climate. ...

Discrediting the exaggerated accounts...of the impossibility of escaping the jungle fever, I had yet resolved...to quit the field as soon as I had taken the necessary observations at Yellapooram, and fixed the stations in advance. The immense saving of time which would accrue from this measure...fully warranted the risk of not returning immediately ; and towards the end of October I marched from Punch Pandol towards Yellapooram, through the wildest and thickest forests that I had ever invaded. ...

The distance from Punch Pandol to Yellapooram is about thirty-one miles in a straight line ; along the route we took it is little short of sixty-four. I made the first two journeys with my camp at the rate of about sixteen miles a day ; but, growing impatient on the third day, I mounted my horse, and reached the village of Yellapooram late in the evening.

It was a very fine morning. The sun rose unusually bright and brilliant as I ascended the steep side of this never-to-be-forgotten hill. When I reached the summit, the prospect which greeted me on all sides was most exhilarating, for the great Godavery which was to terminate my labours...glittered in full view before me.

The eminence was most fortunately situated, and seemed to have been placed there on purpose to accomodate me, for, had it been a hundred yards to the north, the ray to my western station of Kotajpoor must have been obstructed. ... To the north and west and north-east, there were peaks...to furnish well proportioned triangles, and so isolated that there was no doubt of their being reciprocally visible or easily discovered. Further, there were a multitude of small eminences in the neighbourhood, admirably adapted for...laying down the whole course of the river ; there were also islands in the channel, and an evident facility of fixing the point of conflux of the Pranheeta, a large river which flows into the Godavery[1]. ... Three parties were immediately detached to occupy the three peaks, ... and I hoped in, ... a few days to complete the observations, ... in which, had success attended me, I should, to use Colonel Lambton's words, 'have performed a very magnificent work indeed to start with' ! ...

Buoyed up...by the full vigour of youth and a strong constitution, I had spurned at the thoughts of being attacked by sickness, against which I foolishly deemed myself impregnable ; but my last day's ride through a powerful sun, and over a soil teeming with vapour and malaria, had exposed me to all the fatal influence of these formidable forests. On the 2nd. of October, in the evening, I found myself labouring under the effects of a violent typhus fever. Mr. Voysey was seized very soon after ; within the next five days the greater part of my camp (nearly one hundred and fifty in number) were laid prostrate ; and it seemed indeed as if at last the genius of the jungul had risen in his wrath, to chastise the hardihood of those rash men who had dared to violate the sanctity of his chosen haunt. ...

All hope of completing the work this season being now at an end, it remained only to proceed with as much expedition as possible towards Hydrabad. ... To fly...was indispensable. A litter was made for me ; Mr. Voysey had a palanqueen, and a rebellious chief of the fort of Chelwaee...aided my progress most manfully with men and provisions ; but the jungul fever pursued my party like a nest of irritated bees long after we had quitted the precincts of the forest, and on the arrival at the head-quarters of my unfortunate followers, it appeared that not one individual had escaped the fever, and that fifteen of their number had sunk beneath its severity, and been left to perish miserably by the road-side.

I had reached Hydrabad some days before this wretched troop, and on the first intelligence of the calamity being communicated to the British Resident, Mr. Henry Russell, and the commandant of the troops, Colonel Boles[2], I can never forget the alacrity these gentlemen displayed in affording relief to my distressed followers. The whole of the public elephants and doolies (litters) and camels were immediately put in requisition, and despatched under a strong escort to meet them ; ... when, at last, they were brought in, they bore little resemblance to living beings, but seemed like a crowd of corpses recently torn from the grave[3].

The following June, 1820, Everest was sent out again with the same party to complete the interrupted programme ;

But the zest of the work had terminated to the south of Yellapooram ; all to the north was comparatively child's play ; and after having taken the necessary observations, ... and laid down that part...of the Godavery...intersected by the meridian of Karangoolee, finding my health and constitution gradually sinking under another violent attack of jungul fever, and

[1] near Sironcha, 56 N/NE. [2] Thos. Boles, Mad. Inf. Ens. 1788 ; Col. 1819 ; M. Gen. 1830. [3] Geo. Everest (9–21).

deeming it unwise to sacrifice myself for an unimportant object, I left...Mr. Olliver to fill up the blanks which remained, and proceeded on medical certificate to the Cape of Good Hope[1].

Thus was that great man George Everest initiated into the work of the Great Trigonometrical Survey, to which he was to devote the best years of his life. O the many improvements that he was to introduce none was more far-reaching than his device which made it possible to work right through the cold weather, and avoid the pestilential climate of the rains [235–6]. But though he came back from the Cape refreshed and invigorated, he was never again the vigorous strong young man who defied the elements. The repeated infection of malaria of those two seasons clung to him for the next twenty years.

ADVANCE TO BERĀR, 1821–2

After Everest's departure on leave, August 1820, Olliver and Rossenrode finished off the programme south of the Godāvari "in a most complete manner". De Penning then completed the connection east of Kurnool by March 1821, after delay from "the extreme difficulty of that mountainous country". Lambton now submitted a chart of the triangulation to the east[2] [pl. 18];

What from sickness and innumerable local impediments, the work has taken up two seasons, and has cost more trouble...than four times the extent in any part of the Company's territories would have done. This sketch includes the principle triangles only, but there are upwards of 280 secondary triangles that will appear in my next general report, which I shall be preparing till the hot winds and the first rains are over, when I intend taking the field myself, and remaining out till the beginning of March next; after which I shall sit down to finish my report of what will be done in the Dekhan. It is to be regretted that the whole country canot be covered by a complete network but, as my force is not competent to that purpose, I must be satisfied with making the best arrangements I can for carrying on single series[3].

He was now free for the northward extension of the great arc;

The time is fast approaching when I shall direct my operations into other countries. My next excursion will be to the northward, as high as Ellichpoor, and if I move after that to the westward, it will be into the Poona district. My northern expedition will be under my own immediate direction, ... adding another link to the great chain which was originally intended to stretch through Hindoostan, and connect Cape Comorin with the upper provinces of Bengal[4].

At the beginning of the rains, his established season, Lambton set out towards the north with his whole staff. Picking up the work where he had left it at Nānder in 1817 [223–4], De Penning had, writes Everest, carried the triangles to Pilkher within sixty miles of Ellichpoor; but the constitutions of all the establishment having been thoroughly unhinged at Yellapooram were now highly susceptible of sickness, and a fresh attack of jungle fever very soon rendered it necessary to form a field-hospital at Karinjah, ... and of course all operations were suspended [244]. The Lieutenant Colonel had quitted Hydrabad at the same time, ... but took no share in the triangulation, and remained at Ellichpoor in cantonments until the sickly season had passed, when he commenced measuring a base-line in the valley of Berar, at a station near the village of Takal K'hera [pl. 18].

At the same time that this operation of the base was in progress (January and February 1822), the Lieutenant Colonel had [set] up the zenith sector [II, 260; III, 253] at a station in the very alignment. ... He was in a constant state of exertion and fatigue by day in superintending the measurement, ... exposed to...a tropical sun, and unaided except by Mr. Voysey and a few natives; for all those on whom he might have relied in this hour of necessity were disabled by sickness and the reckless exposure to which he had subjected them.

By night, instead of reposing...from his labours, he continued to take the zenith distances of those stars which he had before observed at Daumergidda and other stations more southerly; ... but here he had no person...to relieve him from his toil, for Mr. Voysey, though willing and zealous beyond compare, had no mathematical acquirements, either theoretical or practical, and ...could not be entrusted with the use of an instrument requiring so many delicate precautions

[1] Geo. Everest (21). [2] *Sketch of the Principle Triangles extending over that part of the Nizām's Dominions, lying to the Eastward of Nirmul & Kurnool*, by Lt-Col. Wm. Lambton & Capt. George Everest; 8 m. to an inch, pub. by James Horsburgh. Hydrographer to E.I.C.; 1–3–27 engd. J. & C. Walker; bound with Geo. Everest; MRO. Map 531. [3] DDn. 191 (175), 19–4–21. [4] DDn. 92 (72), 13–2–21.

as the zenith sector. The consequences may naturally be anticipated; ... his constitution received a death-blow which it never recovered; and the observations for zenith distances proved ...to be so wild and confusedly registered, that it was impossible to turn them to any account. ...

During this lamentable condition of affairs [continues Everest], I was on my return voyage from the Cape of Good Hope, the fine climate of which had most thoroughly renovated my health; and immediately on reaching Madras, I set out to join the Lieutenant-Colonel at Takal K'hera (a distance of seven hundred and sixty miles), with my constitution as fully re-established as if I had never been ill.

It took me thirteen days to perform this journey, and when I reached my destination I found that the zenith sector had been taken down. ... Two days after my arrival...Colonel Lambton proceeded back to Hydrabad, leaving me with instructions to fill the gap of sixty miles between the base-line and Peel K'her[1] [pl. 18]. But this, without men or tents, ... was totally out of the question; and, as the connection could be better formed at a more fitting opportunity, I and Mr. Voysey also returned to Hydrabad; so that, after having made this journey of three hundred and sixty miles, the whole establishment marched back, in order to make it again at some future period[2].

On his return to Hyderābād, Lambton submitted a sketch of the triangles, optimistically described as extending to "the neighbourhood of Ellichpoor";

The country through which these triangles have been carried afforded...few objects by which geography might benefit; but the whole tract from the Godavery to the borders of the Berar valley is in a desolated state, with only here and there a ruined village; and the excessive sickness of the party, added to the poverty of the country, have rendered this expedition of little importance excepting the mere continuation of the triangles which, however, will be of service should this hitherto ill-fated country ever become settled and cultivated. The stations being all permanently marked will then become of use in extending the detailed surveys[3]. ...

I have frequent application made to me by persons conducting surveys for data. For instance, a survey of the Poona district by Major Sutherland [124–5]; and a survey in the western part of Nagpoor authorised by the Resident [90].

In addition to the triangles, an extensive base-line has been measured for a new departure to the northward; and also a series of astronomical observations made for...determining the length of another degree on the meridian.

The measurement of the base, and the observation of the stars, are matters of great delicacy and importance in a work of this kind. But from the sickness which prevailed, and which deprived me of the aid of four sub-assistants, it would have been impossible for me to accomplish what was necessary had it not been for the zeal and activity of Mr. Voysey who with ready cheerfulness put his hand to everything that could forward the service. ... He and I had to perform the whole operations at the base and, while I was afterwards taken up in observing the stars, he was employed in taking angles at the neighbouring stations.

Whilst the Great Arc could now be extended northward "till it fall upon the Jumna" [194], he proposed to send Everest

to the westward, to commence from some part of this meridional series, and proceed thence towards Poona, and ultimately to Bombay. As I shall conduct the operations through Hindoostan myself, it is probable that I may reach Agra about the time that he will arrive at Bombay. There will then remain to be done a very important part of this survey, viz., a continued triangulation through the Northern Circars from the Masulipatam district to Point Palmyras [223], and finally to Fort William if possible. ...

I shall move to Nagpoor in the course of the present year, and be ready to commence where I have left off, immediately after the rains in 1823. ... I may venture to say that in 1826, if my health continue, the connection between Cape Comorin and Agra on the Jumna will be completely effected[4].

But the great-hearted worker was now close on seventy years of age, and his strength was rapidly failing; Everest found it melancholy

to witness the progressive decay of this great man, both in mind and body. ... The paroxysms of his cough were sometimes so violent and awful, that he used to lie on his back exhausted with the effort, and apparently in imminent danger of bursting a blood-vessel. When he rose in the morning he appeared to be in a state of torpor and, though he now and then seemed to rally and to recover his faculties, yet it was evident to all who saw him that he was hourly getting worse, and must ere many months elapsed sink into the grave.

[1] which De Penning had failed to complete [232]. [2] Geo. Everest (22–4). [3] cf. TS. V. (3). [4] DDn. 92 (220–6); 195 (133–42), 29–4–22.

Still he talked as if he was insensible of what every other person saw so palpably; formed project after project, which were to be executed *when the great arc had been brought up to Agra*[1].

Everest later found that the triangulation by De Penning and Lawrence north of Bīdar was of very poor quality, and vitiated the value of the whole section from Bīdar to Tākarkhera;

Though it might be perfectly unobjectionable to entrust the conduct of a series...along one of the subordinate meridians, or even part of the principal series under certain limitations, to ...a person who from long trial has been found...skilful, ... yet it is rather too much...to leave the entire and almost uncontrouled management of so delicate a work to any person whatsoever. Expert...as Mr. De Penning unquestionably was, yet he was a mere practical man, without any knowledge of the common principles of mathematics [237]; and as to Mr. Lawrence, ... he was notoriously given to intoxication. ...

To the management of these two individuals, however, the whole of the terrestial measurement of the 5th section to within 60 miles of Ellichpoor was left, and Mr. De Penning...who carried on all but the three first triangles...was entirely his own master, for during...his operations the late Superintendent was not even in the field. Hence, and from other causes, ... the 5th section was a very vulnerable performance, and highly open to objections. ...

Nothing further was done with these operations during the life of the late Lt.-Colonel Lambton. ... When, therefore, ... I succeeded to the department, I found that, instead of the operations having been carried up...to the vicinity of Ellichpoor, as the Supreme Government had been led to suppose, not only the principal triangles for the last 60 miles remained to be constructed, but an entirely new set of stars required to be observed [253][2].

Later on Everest completed the section Pilkher to Tākarkhera, and took fresh astronomical observations himself [245], but there was no opportunity to revise De Penning's work to the south till 1839.

EVEREST'S WESTERN BRANCH, 1822–3

Everest started out on his expedition to Poona in October 1822, delighted to be given a definite independent task, and to be left to carry out work in his own way. With Lambton's great theodolite [II, 253] he was to run a series of single triangles commencing upon our great meridional series between the latitudes of 18° and 19°, and proceeding in a direction nearly west, so as to take in Poona and ultimately fix the position of Bombay. ... When you reach the sea coast you will have an opportunity of comparing with our elevations above the sea. The best way will be to make the sea where it may be most convenient, and work your way to Bombay afterwards. ...

As the chief object of this undertaking is to fix with geometrical accuracy the latitude and longitude of Bombay with respect to the Observatory at Madras, it will be necessary to ascertain with precision a certain number of positions in latitude and longitude. ... Distances must be selected if possible between sixty and seventy miles in length, and as nearly from east to west in their direction as possible, so that the difference of longitude...may be determined by pole-star observations; ... and, to assist you in making these observations I have furnished you with a proper lanthorn, by which you can have a referring light.

To carry these operations from the meridional series entirely through to Bombay will be a work of great extent and delicacy, but as I have full reliance on your judgement and abilities, ... I forebear giving any specific instructions[3].

The work was interesting and the experience invaluable;

The series diverged from the side (Daumergidda to Boorgapilly) of one of the triangles of the great arc, which Colonel Lambton and myself had visited in company three years before, at our first acquaintance [227–8], and ended with the side Chorakullee to Sawurgaon[4], ... and as two western stations had been selected which would have advanced the series about sixty-five miles further, more than half my labour might be looked on as terminated [pl. 18]. ...

As we go farther westward we meet continually isolated hills...about two hundred feet above the plain, the lower part of which is basaltic, whilst the top is covered with a sort of crust of iron clay...burrowed through into unfathomed caverns, which the hyenas seem to select as their favourite abodes. At one of these places I had a station, ... and the path by which I and my people passed to the instrument went right close to the abode of a pair of

[1] Geo. Everest (24). [2] Everest to SG., 5-9-25; DDn. 171 (350). [3] DDn. 92 (226, 240, 248, 250), 4-5-; 18-9-; 21-10-; 9-12-22. [4] 18 m. N. of Sholāpur.

striped hyenas, who, though they doubtless found this...proximity rather irksome, yet did not altogether discontinue...their visits to their favorite haunt, to which I have seen them go in open day. In fact, one of these luckless creatures was shot by a party of my sepoys. ...

The face of the country is quite denuded of trees ; here are no jungles to foster fevers, no musquitos to torment, no banditti to infest the path, no roaring rivers to cut off communications ; but a fertile and well-peopled country inhabited by the Mahratta tribes, who are the best-natured and the kindest of all the natives of India.

I was, at the outset, somewhat perplexed by the extreme shortness of the sides of my triangles, for which basaltic formations are frequently ill suited, rising as they do into long ridges, one of which hardly overtops the other. But on reaching the station of D'haroor the face of the country seemed to become more open, and a ridge...seemed to offer me an opportunity of getting a distance of nearly forty-five miles.

It has ever been my object to preserve the symmetry of triangles, ... and it would have been in opposition to this principle to deduce this increased distance from one not exceeding twenty miles. But it seemed very difficult to procure a station to the north of D'haroor, ... for the view was limited in that direction by a range of hills, ... and that range seemed to obtrude itself most uncivilly in the direction of my vision.

The exploring party...selected the station of Chorakullee, from which they sent word that they could see the whole range on which D'haroor was situated ; yet, though on the highest point of that range, I could by no means get a glimpse of Chorakullee, ... which the wild imagination of my native followers attributed, as usual, to magic.

Orders were sent to them to build a large tower of stones, to the height of thirty feet if needed, and I commenced a similar fabric at D'haroor, resolved that no means should be omitted to overcome the obstacle. The work of building commenced at daybreak, and did not terminate till after sunset ; and as the mornings are very seldom clear in India, it was only in the evenings that an opportunity presented itself of knowing how far the increased height had aided my design.

At last, when my tower had risen to the height of twenty-four feet, and the opposite one to about twenty, a clearer morning than usual shewed me not only the tower, but the whole range of Chorakullee on which it was situated, lifted high up in the air, and peeping far above the intermediate obstacle [244].

People were despatched to hoist, immediately after dark, a large mast...with a torch at top of it. The instrument was put up at five o'clock in the evening on the D'haroor tower, and the intervening range was found to stand at a depression of seven minutes and a half. Beyond, nothing was seen, but about eight o'clock the light of the torch appeared in the field of view at nearly seven minutes depression. I watched it rising up the vertical wire till it gradually came to within three minutes of zero, and I then gave over further building, fully assured that nature would help me more by the increasing terrestial refraction of the night, than any tower less than two hundred feet high could do. Prior to this it had been the custom in the Great Trigonometrical Survey to use flags and masts with piles on all ordinary occasions, and blue lights in long distances [247–8]. ...

To supply the want of reverberatory lamps which could not be obtained in India, the following expedient was resorted to. A small cup, six inches in diameter, filled with cotton seeds steeped in oil and resin, was put under a large inverted earthen vessel, ... with an aperture cut in the side, and lighted. This answered exceedingly well in all but windy weather, ... and I have, on one occasion, taken an angle very satisfactorily between two of these small lights at the distance of thirty-one miles [248]. ...

This...has changed the whole face of the Indian operations [9, 232, 246–7]. The cold season, which commences in November, and the season of hot winds, which begins in February and ends in June, are not unhealthy, though the latter is rather parching and disagreeable. They are most unfavorable to terrestial observations by daylight because there is a dry mist, ... through which the telescope cannot penetrate ; but this sort of mist is so completely pervious to night-lights, that for distances of forty and forty-five miles we can carve a passage right through it, even though it be so thick that the sun appears to set in a sea of molten lead.

Precisely the reverse takes place in the rainy season. The climate is throughout most fatal to health and comfort, and towards the close (September and October) it is quite deadly. Yet the sky is limpid beyond anything that can be imagined, except when mists take place ; and these are utterly impervious to the rays of even a blue light [II, 259].

The method of selecting stations...has been considerably facilitated by a very simple method. ... The exploring party have orders to amass two piles of wood about twenty feet distant, and set fire to them simultaneously, so that a pair of blazing bonfires gives warning of success, and serves to light lamps at the surrounding stations [244]. ...

The distance from D'haroor to Chorakullee, being upwards of thirty miles in length, was sufficiently well calculated to connect by a right-angled triangles a station called Laol, about forty-five miles off; and the latter distance was equally suitable for deducting another distance to a station called Allusoonda, about sixty-five miles to the westward. Nothing could be more favourable to my progress; all was cheering and *couleur de rose*; and I was busily occupied by looking out for my blue lights on the distant station, when a letter reached me from Sir Charles Metcalfe [117] communicating the death of my venerable predecessor [9][1].

Hearing of Lambton's death, Everest closed down work, marched in to Hyderābād, and took charge of the survey pending his formal appointment. His branch series was re-observed fifteen years later, and extended to the west coast as the Bombay Longitudinal Series[2].

PASSING OF LAMBTON, 1823

In October 1822, whilst Everest was starting towards Poona, Dr. Voysey was sent to explore the country between Ellichpur and Agra. He travelled first to Calcutta, probably by sea from Masulipatam, thence up to Agra, and then south to Nāgpur, where he arrived several weeks after Lambton's death, having collected information that was to be of considerable value to Everest.

Pursuing his plan of moving headquarters to Nāgpur, Lambton set out from Hyderābād about the 12th December with the whole of his staff and equipment[3]. In the absence of Voysey and, not himself being fit to make so long a journey without medical attendance, Lambton obtained the services of an assistant surgeon named Morton[4] to accompany the party to Nāgpur. The strain of the journey even so, proved too much, and from 23rd December he became seriously ill. He persisted in marching forward, and eventually died on 20th January at Hinganghāt, about 20 miles from Wardha, and five marches short of Nāgpur [pls. 18, 22n.]. He had obviously been suffering for a long time from tuberculosis for, writes Everest, "on dissection it appeared that the right lobe of the lungs was nearly consumed, and the left slightly injured"[5].

De Penning and Morton marched on to Nāgpur, where Morton directed the disposal of all Lambton's private property, and unfortunately a certain amount of government property as well. De Penning then remained in charge at Nāgpur, working on computations till he joined Everest at Tākarkhera in the autumn. Voysey reached Hyderābād in June, having visited Hinganghāt on his way [243].

General Walker has left the following appreciation of Lambton's work. After pointing out that he was 47 years of age[6] when he commenced his survey in Mysore in 1800, an age within eight years of that at which servants of the Government of India are now due for superannuation, he continues;

> Until within a few years of his death, at the age of 70, he seems to have scarcely known ...a day's illness, though he never spared himself, nor shrank from accepting his full share of privations to which all the members of the survey were exposed, and which even Captain Everest thought...almost unjustifiable; he accepted these as a matter of course, and seems to have thought little, and said less, about them, rarely alluding to them excepting when he was endeavouring to obtain promotion for his subordinates who had shared them with him [228].
>
> His life was an entire devotion of self to the interests of the public service and the advancement of science, without a thought of ever ceasing from his labors while life lasted; and as he had ever looked forward to dying, so he died, at his post[7].

COMPUTATIONS & REPORTS

After 1815, Lambton took very little part in field observations but devoted himself to the indoor work [223]. The reasons for this were two-fold.

[1] Geo. Everest (25–32). [2] *GTS.* XII (vii. B); TS. 8; GBO. Comp. Q-1/13; *GTS. Syn.* xxvi. [3] DDn. 92 (250), 9-12-22. [4] John Morton (1796–1866) Mad. Med.; Asst. Surg. 1818: Surg. 1830; m. Poonamallee, 5-6-24, Aphra Johnston Boyce, who d. Masulipatam, 2-10-35; ret. 1847; d. 28-1-66 at Clifton. [5] Geo. Everest (32). [6] assuming birth 1753, though it might have been as late as 1756 [II, 411]. [7] *GTS.* I, xxxii.

Plate 18

RAJAH OF BERAR DOMINIONS
NIZAM'S DOMINIONS
Asseergurh
Boorhampoor
Dhar
Salbaldi
Gawilgarh
Gawilgurh
Ellichpur
Ellichpoor
Nurnulla
BASE
Takalkhera
Ashti
Ner
Yaholi
Kamptee
Nagpoor
Wurda R.
Taptee R.
Dhurumgaum
Poornah R.
Badali
Omraoutee
Wirur
Badgaon
Pilkher
Ikjhera
Hinganghat
Kopdi
Bam
R. Wurda
Jafferabad
Kurhur
Maiker
Acola
Bassim
Payne Gunga R.
Sakri
Dowlutabab
Aurungabad
Jaulnah
Chanda
Mahur
Hingolee
Sukli
Bitergaon
Pyton
Shevni
Terban
Patree
Bhesa
Somtana
Godavery R.
Nirmul
R. Godavery
Periaiahmulla
Tattawaya
Bheer
Darroor
Yemsha
Koodaunpoor
Yairguttah
Kistnapett
Sironcha
Shevalingapa
Moonpully
Deekondah
Bopaulputnum
Manjeera R.
Timmapooram
Ramgeer
Pertaubgeeree
Wudwul
Bakthapoor
Syed Yadulah
Gudkolee
Chorakullee
Hurrangool
Oodgheer
Yenagapali
Porendlah
Eilgundell
Purrainda
Nitull
Kowlass
Burgapilly
Achola
Boorgidda
Anantageree
Mullangoor
Yellapooram
Kurrusgaon
Moonganal
Bachapali
Kotajpoor
Darroor
Thairna R.
Damargida
Meduk Drug
Medduc
Yellamuldawgutt
Innaparatee
Sawurgaon
Deobett
BIDAR BASE
Beder
Dudala
Warungul
Chonchilkotah
Nuldroog
Shilapali
Tadmanur
Suldapooram
Punch Pandol
Tarrapoor
Aunimcondah
Boleekonda
Sholapoor
Goraegat
Koelcondah
Letchmapooram
Bolarum
Topkonda
Bhongeer
Kotamarpullee
Secunderabad
Keesshergutt
Bhoonageer
Thullapullee
Golcondah
Hyderabad
Goonigutt
Annantagherry
Chebellah
Gaunigapent
Koolburga
Mulkapoor
Kundagutt
Kummunmett
Purgy
Uddagutt
Mulkair
Kotakodungal
Bodumpaud
Cullipully
Oopulgutt
Dunnarum
Nelgoondah
Nelgoonda
Nealamurree
Anantageeree
Kaunkoortee
Pochamagutt
Jonelrashgutt
Surrycondah
Beejapoor
Myshagitt
Kandakoor
Edgheer
Impahgutt
Koilcondah
Baudapully
Davurcondah
Daverconda
Tirmellapungutt
Poolychintah
Ellore
Sarangapully
Suggur
Ghunnapoora
Narlainee
River Kistnah
Bozorah
Kotapullee
Gurromurtee
Toomaingutt
Gangadawyhulwa
Kistnah R.
Moonanoor
Amrabad
Kaukiral
Guntoor
Yerragutt
Pangull
Putchagutt
Kolem
Soodeecondah
Masulipatam
Rachoordroog
Raichour
Darroor
Kuladgee
Malliabad
Yellacondah
Peddacoorwa
Doorgupcondah
Moodgul
Innaparatee
Siddapoor
Toongabudra R.
Haulwah
Kurnool
Kaumingut
Karrae Bellagul
Kuttalcondah
Mouth of the Kistnah
Adoni Droog
Cumbum
Ongole
21°
20°
19°
18°
17°
16°
76°
77°
78°
79°
80°
81°
W Lambton
S. T. S. of India
Geo Everest

Plate 18

GREAT TRIGONOMETRICAL SURVEY, 1814–24
NIZĀM'S DOMINIONS

Detail in black shows work of the Great Trigonometrical Survey, 1814–24, with the Great Arc in thick lines as extended into the Nizām's Dominions by Lambton [II, 249], and by his assistants to Pilkher [III, 232–4], and again by Everest, 1823–4 [242–6].

Secondary triangulation by De Penning and Everest east of the Great Arc is shewn in fine lines [223–32], 1817–21, as also is Everest's Longitudinal Series to the westwards, 1822–3 [234–6].

The map in brown is reduced from one on scale 32 miles to an inch, compiled at the Surveyor General's Office in 1856.

Printed at the Survey of India Offices (H. L. O.)

Firstly his age, which was at least 60 years in 1815, and rendered him disinclined for arduous field duties, more especially as he was suffering from consumption without being aware of it. He felt that he could well leave the comparatively mechanical work of triangulation and manipulation of the theodolite to the assistants who had for so long been trained in his methods.

The second reason was the overriding necessity of all the routine computations being carried out under his immediate supervision. His assistants were of limited education, and Everest points out that De Penning "had not a particle of mathematical knowledge beyond decimals, the use of Taylor's Logarithms, and the square and cubic root [234]" [1]. Lambton describes " the tedious and complicated nature of these different computations ", in which, to avoid all chance of error, he

always put the computers (having formerly four) two and two together, dividing the work so that two might go over the same ground as a check to each other, and when they had finished, they changed their parts and went through the whole again, so that each two might be a check upon the other two. All this being done, the whole was revised by myself.

All these precautions are necessary to do justice to a work of this nature, which is supposed to become a groundwork for all other surveys ; but it requires much time for the calculations, and in general as much may be done in the field by a party in four months as will require six, and often eight, months to bring up the indoor work[2] [255].

He took more than two years to complete volumes III and IV of the computations, which covered all work south of parallel 16° [II, 264][3].

I have...been at the pains of recomputing all the positions recorded in the 1st and 2nd volumes of my General Report. The continuation of this meridional arc to the northward, and the extensive similar measurements made in Europe which by this time have connected the Balearic Islands with the Orkneys, will afford still further means for approximating to greater accuracy [226] ; ... but, for the mere purpose of geography as far as relates to the peninsula, what is contained in these two volumes (3rd and 4th) will never require correction[4].

He made three copies ; one for the Supreme Government, one for the Surveyor General, and one for himself[5]. When a fourth copy was called for he asked that the Surveyor General's copy should be passed to the Directors ;

Such a work could not be copied in any office, ... principally on account of the mathematical formulæ which it contains ; and also from the numerous tables of triangles, latitudes and longitudes, zenith distances of stars, etc., all of which ought to be copied by the persons who computed them, and that under my own eye.

With only three persons, it will require at least five months to make the copy and plan, besides some time to collate them. ... The time taken up in these reports is a very serious drawback on the field service and, besides, they contain a great deal which can be of no use to a Surveyor General who, in fact, wants nothing more than the triangles and the latitudes and longitudes, which he can always have by applying.

On the other hand, he was always ready to make special extracts for the Surveyor General, for Garling, or the Resident. He believed in co-operation[6] [116].

Besides the computation of triangles, co-ordinates, and heights, Lambton was continuously occupied with calculations for "a desideratum still more sublime" [II, 250], the figure of the earth, and abstruse phenomena affecting terrestial and astronomical measurements. In this work, except for continual reading of published works, and correspondence with leading geodesists in Europe, he was struggling unassisted in a science that was yet in its infancy, and to which his own work was making a very important contribution. After working out the values given in his reports of 1818, he recomputed them yet again in 1821[7] [II, 262] ;

In 1818, Colonel Lambton, by combining each of the three sections of his arc with the English, French, and Swedish measures respectively, obtained the mean value of 1 : 310 for the compression at the poles, and thence computed a table of lengths of a degree from the equator to the pole, from which the elements of all his trigonometrical stations were determined. But in 1821, owing to the adoption of Mr. Bird's scale of 1760 for the standard of length by the Parliamentary Commission, ... all this work had to be repeated.

[1] Geo. Everest (33). [2] DDn. 144 (195), 22-7-18. [3] to SG. 10-1-18 ; DDn. 62 (143). [4] to Pub. Dept. 1-1-18 ; DDn. 63 (441) ; TS. III & IV. [5] GBO. Comp. Q (1-4) ; Lib. H.v. 19 (1-4). [6] DDn. 63 (441-459). [7] GBO. Comp. Q-1 (7, 8).

From experiments made by Captain Kater...the Indian standard scale required to be decreased by 0·000018 of its length, ... whilst Ramsden's bar used in the...survey of Great Britain had to be increased by 0·00007 of its length. ... The Indian arc depended on both these standards, and all the results obtained from it had now to be corrected. ... Each of the three degrees obtained from the Indian arc was now compared, firstly with the French measurement, secondly with the English, and thirdly with the Swedish, and from these data were deduced three mean eccliptics, the mean of which was taken to give the true compression at the poles.

The actual dimensions of the earth, and the length of the French metre were also deduced by Colonel Lambton from the data afforded by his Great Arc[1] [II, 262].

Abstracts of his results up to 1818 were sent to the learned societies of Calcutta, London and Paris[2], and he was specially delighted by the appreciation of the great French geodesist, De Lambre, who writes from Paris, 30th May 1818[3];

I first of all received your letter, and, shortly after, the extract of your new memoir, which was sent me from London. ... I have translated your letter, and I flatter myself that you will not blame my haste in spreading it through Europe by means of the "Connaissance des Temps", which, however, will not be done until after its publication in the Philosophical Transactions.

Your new measurements and new calculations will be seen with great interest. I have already...given your former results, and your comparison of the different degrees. I had noticed what I had discovered by our formulas with the assistance of your data; the former being a little simplified to bring them nearer to your suppositions. ...

Everywhere I have had the satisfaction to find our agreement with you. Our metre calculated from your operations differed only 0·015, which you make so much smaller. You now reduce this difference to one-third. ... We may now flatter ourselves that we know the general figure of the earth. All the great operations of India, of England, of Sweden, of France, and of Germany, lead to the same results[4]. When they are considered "en masse", it is not necessary to pay attention to the trifling irregularities of parallels and contiguous arcs. There is no absolute demonstration that the meridians are perfectly regular ellipses, and all equal one to the other; that the strata of the earth are exactly symmetrical, or that the best instruments have not some errors. ... Let us redouble our efforts to diminish the slight anomalies by new researches, and let us multiply as much as possible our observations and those scientific enterprises which, like yours, will confirm the glory of the philosophers of the 19th century[5].

Lambton's general report on the work between the Kistna and Godāvari was lying unfinished at the time of his death, and it was some time before Everest found the staff and time to complete the three copies. He writes in 1824 that

not one is yet complete, for it cannot be considered so until it has been fairly transcribed from the original documents, and afterwards rigorously compared with them. ... Within the last twelve-month I have been immersed in...correspondence, the bare copies of which already fill a large folio volume, whilst, on referring to the books of my predecessor, I find whole quarters elapse without a single public letter. ...

For many months to come an adequate number of good writers should be placed at my disposal, and...a strong and commodious office tent should be furnished. ... Hitherto a regular office has never been held in the field, and it was not until I joined the department that the practice of making even the rough calculations was introduced, but in 1819 I found myself so perfectly my own master...that not only the rough calculations, ... but the spherical excesses, the chord corrections, all the principal triangles, the relative heights of the stations, and even the great part of the secondary triangles, were computed in my own tent[6].

The first of these volumes, MS. Report No. V, describes the work on the Great Arc between the Kistna and the Godāvari, with discussions on the length of the metre, pendulum experiments, refraction, and local attraction. It was signed by Lambton himself, and countersigned by Everest in 1832, when it was issued with No. VI, which included Garling's triangulation[7] and Everest's series to Bombay.

In 1848 a suggestion was made from London to collect the many disjointed accounts left by Lambton, and publish them with an introductory memoir. Waugh rejected this because, as he said, the computations had not always been verified by a second computer[8], and "the reduction of the star observations...were conducted on

[1] Burrards' account; *GTS.* XII (appx. 48–56). [2] *As R.* XII (286–365); XIII (1–127); *Phil Trans.* 1818 (486–517); with charts; cf. *IO Cat.* (32–3). [3] Translation by Waugh, *PR.* (25). [4] *v.* discussion, *GTS.* XIII (appx. 48–56). [5] cf. Gore (175–8). [6] DDn. 171 (281), 29-7-24. [7] TS. V, VI; GBO. Comp. G–5 (5, 6); Q–1 (5, 6) without charts. [8] but see Lambton's statement [237].

the imperfect principles of those times, and the places of the stars have since then been determined with more accuracy".

Neither could he recommend the revision of Lambton's calculations *ab initio* from the original records, for which no staff could be spared. His observations and measurements no longer met the latest standards of accuracy, and there was no exact value for his standards of length [II, 267 ; III, 249-51].

The next difficulty arises from...the [former] practice among all scientific men to pick and choose observations. This practice has now been universally abolished. ...

As the zero of the instrument was not systematically changed, the mean angles are burthened with considerable instrumental errors. ... Luminous signals were not introduced in those days excepting blue lights, which were rarely used, and, unless these are carefully screened from the wind, their correspondence with the centre mark cannot be relied on. ... Another material source of error is the want of isolation of the instrument. ... Angles taken on the old platforms might be vitiated to the extent of 5 seconds by unsteadiness. ...

Undoubtedly Colonel Lambton's operations are fully equal, if not superior, to the best... of his own times, and no man could have achieved more with the means at his disposal. His name is reverenced...as the Father of Indian Geodesy, and anecdotes of the talents and energy of this great man have been handed down to his successors, ... but there can be no doubt that if Colonel Lambton himself were now alive, he would advocate a revision of his observations with the superior instruments and processes of modern times. ... This has been done with works of the same date...in other parts of the world, and...would by no means derogate from this great geodesist's fame. ... All the skill we now possess is derived from the experience he gradually acquired, and which was perfected by his successor.

Waugh went on to quote Everest's remarks on the re-observation of the section north of Bīdar [223-4] ;

Though much merit will doubtless be conceded to the personal operations of a geodesist so ...talented as Colonel Lambton, yet it by no means follows that the same concession is to be made to everybody...under his orders. ... Indeed, ... confidence...will surely have been dispelled...by the revision of 1838-9 [234]. ... The instruments employed subsequently to the injury done to the larger theodolite in 1808 [II, 241] were all of an inferior kind, unequal to the purposes of the Great Arc, and demanded a rigorous attention to several precautions and minutiae, without which not the most distant approach to accuracy could be looked for.

Besides, it was the practice...when I joined the department in 1818...to use the greatest freedom with the observed angles—...to select such as suited the views of the computer—...a system...by which we may deduce just what...we please[1].

Waugh concluded by recommending the re-observation of the four sections south of Bīdar and suggested that the matter should be referred to the Royal Society[2]. The Government of India had already firmly refused to countenance any such revision when recommended by Everest in 1842[3], and hesitated now to accept Waugh's advice. The matter was raised again ten years later by Everest, and on the strong recommendation of the Royal Society, Lambton's work south of Bīdar was completely revised between 1866 to 1874 [II, 266-7].

[1] from Everest to Mil. Dept. 13-8-42, DDn. 402 (248-369) ; paras. 154-5. [2] from Waugh, DDn. 462 265-307), 15-1-49. [3] BMC. 14-10-42 ; DDn. 401 (203). GBO. Comp. M 9/8; *RS Progs*. 27-1-59.

CHAPTER XVII

GREAT TRIGONOMETRICAL SURVEY UNDER EVEREST

Programme — The Great Arc, 1823–5 — Technical Details ; Luminous Signals - Refraction — Base-Lines — Horizontal Angles — Astronomical Observations — Figure of the Earth — Computations & Reports — Instruments.

BEFORE the news of Lambton's death reached them, the Directors had asked how soon his survey would be completed, as it was costing more than £6,000 a year, and they called for precise information on the particular purposes

to which it is to be applied, both as it may respect geography of the country, and the more general purposes of science. We are favourable to pursuits...improving our acquaintance with the country and the people, ... as well as of the States bordering upon, or situated within, our frontier, but we feel we should hardly be justified in sanctioning the continuance of so large an expenditure...unless...the objects to be attained are of adequate utility.

On hearing that Lambton had died, they ordered that his successor should be chosen with care, and placed under the Surveyor General [308]. They discussed their intention of putting in hand "a complete Map of India" [283], and attached a note by Rennell advocating the appointment of a special astronomer to fix points over the whole country as foundation for rapid geographical surveys. They suggested that this astronomical survey should supplement the Great Trigonometrical Survey in areas where triangulation might be impracticable [185][1].

The Bengal Government had already placed Everest under the orders of the Surveyor General[2], and had no hesitation in recommending him as successor to Lambton [308]. Regarding future programme they referred to Blacker for advice, and he obtained Everest's views on the practical objects to be achieved;

In a scientific point of view the object embraced by the Great Trigonometrical Survey is solely to collect data respecting the long agitated question of the figure of the earth. In a geographical point of view, the design is to establish the correct positions of certain points on the earth's surface. ... The determination of the height of one principal station above another, tho' essentially necessary in order to ascertain the height of the measured bases above the level of the sea, is yet but subservient to the main design, and the determination of...refraction is, generally speaking, altogether incidental...as a mere correction to vertical angles[3].

Blacker then wrote a vigorous letter to champion trigonometrical methods, and to discountenance any suggestion that they could be displaced by the unsatisfactory means of astronomical observations, which were only suitable for rapid exploration [186, 190-1]. He admitted, however, that astronomical control might have to be accepted for flat wooded country unsuitable for trigonometrical operations [185]. He protested against setting a limit on the Great Trigonometrical Survey ;

It is extremely difficult to recommend any restriction of the great triangulation, short of that imposed by the features of the country and the limits of British control ; ... but if such a suggestion were executed, I should propose for limit the termination of the Doddagoontah meridional series of triangles in the Thibet mountains [II, pls. 16, 17], the continuation of the western series along the coast from Goa to Cambay, and the prolongation of that on the eastern coast from Masulipatam to the nearest practical point to Fort William.

From four to five years with the present establishment would be the probable time for the completion of the meridional arc, which may justly be denominated the great axis of Indian geography, and would connect the minor surveys of the Duckhin with those of Hindoostan. ... For the accomplishment of the other two, which would nearly complete a correct outline of India to the sea, ... about four years each would be required.

[1]CD to B. (Mil). 29-10-23 (5-51). [2]thus transferring the GTS. from the General to the Military Dept. [3]Everest to SG., 7-7-24 ; DDn. 171 (216).

I cannot, however, too forcibly, as Surveyor-General of India, deprecate...a restriction so inconsistent with the liberal views under which this survey has been hitherto conducted ; so unworthy of the fame which the rulers of India have already acquired...for their promotion of geodesy, and so destructive of all hopes of an accurate knowledge of the geography of...Central India. Rather, on the contrary, let there be employed more hands and more instruments to give fresh vigour to the undertaking, and to reduce the period...within a calculable time. ...

I feel a difficulty in adding more precise information in regard to the...survey, and the particular purposes to which it is to be applied. ... Without this basis...all detailed surveys may not only be wrong, but extremely tedious; ... no single point can be accurately placed, nor can the extent of India, particularly in longitude, be known without it [pl. 17n.].

One of the great questions...is...the magnitude and figure of the earth. ... (The figure of the earth is so far from being an object of mere curiosity that it affects a large portion of the tables used by navigators. ... No power has more reason therefore to be interested in this investigation than the East India Company)[1]. ...

There is no branch of physical science specially affected by the three co-ordinates of latitude, longitude, and elevation, to which the great trigonometrical operations are not of primary importance ; whilst the changes of gravity in different latitudes, the laws of terrestial and celestial refraction, the phenomena of magnetism and temperature, with several important branches of geology, should probably accompany or follow them.

I have now placed...the continuation of the Great Trigonometrical Survey in the most conspicuous light. I have rejected the methods hitherto followed of an uninterrupted triangulation for that of several meridional series, which appears to me, if less satisfactory, to be a saving of time of 20 years[2]. ... The next alternative comprises the completion of the Doddagoonta meridian, and continuation of the series on each coast ; and if that be considered too extensive, the meridian may stand alone, whilst the survey of the coasts shall be abandoned. ...

No future survey should...be considered final, unless it shall have been conducted on the most approved principles, with appropriate instruments, and by skilful hands [120–1]. ... Since the discovery of high scientific principles, all the advantage derived from the application of them to practical purposes has depended on the accuracy of...execution, which can never be hurried without loss of effect. ... The great desideratum therefore is...the employment of good surveyors, with suitable instruments.

Let these arguments, which challenge contradiction, stand in favour of the continuance of the Great Trigonometrical Survey on an enlarged establishment, commensurate with the extent of country still open to its operations[3].

Between October 1823 and March 1825 Everest completed the field work of the sixth section of the Great Arc, Tākarkhera to Sironj[4], in addition to finishing off the fifth section to the south [232]. His health was shattered by continuous fevers, and he was compelled to ask for leave to Europe on medical certificate. He left men and instruments at Agra and Saugor and, after settling official business with the Surveyor General, sailed from Calcutta on 11th November 1825 [246].

After much discussion as to the best way of employing the establishment during his absence, Government accepted his proposal for a branch series running eastward from Sironj to Calcutta along parallel 24° ;

The management of an extensive eastern or western series, in which latitudes and longitudes are determined, calls for much more skill than that of meridional series, because the former implies the necessity of frequently ascertaining the true direction of the meridian. Both my principal sub-assistants[5] are acquainted with the method to be pursued, ... and...would become sufficiently expert in its practical application, so that...a series of principal triangles might diverge from the Grand Meridional series at either of the sides, Tek to Raneepoor, or Gurhgujja to Bhowrassa [246, pl. 17]. ...

The latter line would embrace the parallel of 24°, and, though the features of the country seem at the outset by no means favorable for the prosecution of a work of the kind, yet there is this advantage that the climate is much more eligible[6], and that the belt would pass over a comparatively fertile and populous territory, so that its results would be of so much the greater importance to general geography.

In my journey from Hindoostan to the Dekkan in 1818 [271], I travelled through a great part...of this latter belt, and I should judge that it would come upon the Hon'ble Company's

[1] Note in brackets by Waugh. [2] the system eventually followed by Everest. [3] DDn. 204 (87–9), 11–8–24 ; *PR* (25–8) gives summary by Waugh. [4] 54 I/13. [5] Olliver & Rossenrode. [6] This did not prove correct.

provinces...in latitude 23° 47½′ N., and that to within 70 or 80 miles of the Presidency there need be no apprehension of a want of mountain land.

But such an undertaking would...call for the most unceasing application for several years. Taking...the chances of sickness and other casualties, I should estimate that 120 miles per year is the utmost that could be expected and, as the whole distance in longitude is about 600 miles, and in latitude about 90 miles, the completion would...certainly occupy upwards of 6 years[1].

Blacker supported Everest's proposal—Joseph Olliver was selected for the charge—and work was started before the end of 1825 [261].

There are, no doubt, other important lines in the Deckan which have been abruptly discontinued[2], ... but...their resumption may be effected at any future period. ... The establishment and all the instruments have already advanced with much difficulty into Hindoostan, and there would consequently be much loss of time and much risk in carrying them back. ... The line I have first mentioned...has the double object of affording bases for topographical surveys in the direction of the lower provinces, and of approaching the meridian of Calcutta with a view to its connection in longitude with the other presidencies.

I have every reason, after mature discussion with Captain Everest, to conclude that the first sub-assistant, Mr. Olliver, is entirely capable of conducting the proposed survey[3].

The Directors thought another officer might carry on the Great Arc during Everest's absence, but though Hodgson considered Herbert "perfectly and eminently qualified" he could not be spared [308], and no further work was done on the central meridian till after Everest's return.

During his five years in Europe, Everest devoted himself to the cause of the survey. On his advice the Bengal Government had indented for the latest and best instruments from home, and he visited the leading manufacturers in England and on the continent to select those best suited to Indian conditions [246, 260]. Again on his advice, the Directors appointed a Mathematical Instrument Maker to accompany him to India. He spent much of his leave writing up an account of the survey from 1818 to 1825 [246], and spent several months with the Trigonometrical Survey in Ireland to bring himself up-to-date.

THE GREAT ARC, 1823–5

On his return to Hyderābād in February 1823 [236], Everest spent some time straightening out the muddle caused by Dr. Morton's hasty sale of Lambton's belongings in Nāgpur, and had much trouble recovering Government instruments, equipment, and papers, that had been mixed with private property.

There was no difficulty in obtaining approval to the northward extension of the Great Arc as Lambton had planned.

The first object was...to complete the series to the south of Takal Khera [232, 244], the next to take an adequate number of zenith distances, with a view to the future determination of the amplitude of the arc to the north [233, 253] and, when these were attained, the work of triangulation was to be carried over a chain of mountains called by some the Mahadeo P'har, by others the Vindaya[4], which rises from...within twenty miles of Takal K'hera, runs east and west as far as the eye can reach and, stretching onwards in a northerly direction, gradually slopes [down] to meet the elevated land about the Nerbudda. ...

The Mahadeo mountains form a great natural boundary between the Deccan and Hindostan. Prior to the Pindaree war they had furnished shelter to many of the predatory hordes of that formidable confederacy. ... The military post of Hoossungabad is on the south bank of the Nerbudda, and close to the direction of my series [pl. 17]. The post of Baitool lies within the series to the east, so that it was very clear that, notwithstanding all the frightful rumours which had prevailed [241, 245], the dangers in this wild tract were much less serious than those to which we had been exposed in our former expeditions ; and though they were sufficiently formidable yet, in case of sickness, relief and shelter were not far distant.

Besides, I had now acquired the knowledge of a fact which was very important, viz., that by using night-lights the operations could be carried on with great facility in the cold weather and

[1] Commenced 1825 ; completed 1832 ; Everest to SG., 5–9–25 ; DDn. 171 (359). [2] Everest's own line to Sholāpur [234–6 ; pl. 18]. [3] DDn. 204 (202–4), 24–9–25 ; approved by Directors CD. to B. Mil, 28–12–27 ; DDn. 217 (153–5). [4] and also Gāwīlgarh [243].

season of hot winds, whereby the cruel necessity of exposing my followers in the rainy season would be avoided [235–6]. ...

I had resolved to remain at Hydrabad until the 15th October, and then march up to the valley of Berar. That part of the establishment which had accompanied the late Lieutenant-Colonel to Hing'han G'hat, and...had gone to Nagpore, was directed also to remain where they were...and then to meet me at Takal K'hera. ... Mr. De Penning was exceedingly anxious to bring them all back to Hydrabad, and thus incur another useless expenditure of time, by marching and counter marching, such as had previously occurred in 1821–2 [233].

Mr. Voysey joined me at Hydrabad in June, having passed through Nagpore, and visited the grave of the late Lieutenant-Colonel at Hing'han G'hat[1].

Voysey brought back valuable information about the country to the north;

Col. Lambton commissioned me to...ascertain the practicability of continuing his great meridional arc...from his base measured at Ellichpoor in 1822 to the latitude of Seronge, and from thence to Agra, and likewise to report on the fitness of the ground at the former place for the measurement of another base of verification [245].

Col. Lambton had for a long time considered...the Gawilghur range of hills as almost insurmountable, from the nature of the surface which was reported to be flat and covered with forest trees, rarely offering elevated points for trigonometrical stations in the vicinity of his meridian. His chief hope, therefore, lay in...discovering stations situated...as to enable him by large triangles to pass over the hills with sufficient rapidity to avoid a residence in them during the unfavorable season. His alternative...was to carry up another meridional series to the eastward...passing near Nagpore [226]. ...

The valley of Berar, averaging 1000 feet above the level of the sea, is bounded on the north by the Gawilghur range[2]. ... When viewed from the plain...the outline is flat and undulating, and no part...much elevated above the other ; but on ascending...the land declines considerably to the northward, and...offers many...groups overtopping the surrounding heights. Nearly the whole surface is destitute of wood, and particularly the summits of the hills.

The valleys and beds of rivers are choked up by the thick forest and jungle, and it is in these places that the miasma is generated. Here also reside an abundance of tigers, the terror of travellers, and so great is the alarm that, if you cannot find...Goands for...placing your flags, you will possibly find some difficulty in engaging others...unless attended by at least two sepoys. I had the misfortune in March last to see one of my servants perish miserably before my eyes, without being able to afford any aid, under the fangs of a ferocious animal which had carried off 5 human beings in 3 preceding months [76]. If I had had a Goand for my guide this accident would not have occurred, as these men are perfectly acquainted with the haunts of these animals, and give warning of approach to them.

Provisions are not to be had except on the great road, if such it can be called, and then only at the principal villages. It will therefore be necessary to provide the camp with buneas[3] from Ellichpoor until the survey arrives at Baitool.

Voysey goes on to describe the country northwards to Sironj, pointing out areas which might be unhealthy, the position of the more prominent hills, and the suitability of Sironj for the measurement of a base ;

Seronge according to the observations of Capt. Fielding is in lat. 24° 6′, and in long. 77° 30′ according to those of Lt. Gerard [89] ; consequently the base may be measured in any part of the extensive level plain. ... Should the longitude of Seronge be found erroneous, or 10 miles further east, the base must still be measured in the plain, the numerous gaps and ravines on the hills not admitting of such a measurement.

He climbed several prominent hills suitable for trigonometrical stations ;

The road to Bhorghur lies by Baitool ; there was formerly a direct road, but I could get no person to direct me as it had been for a number of years unfrequented on account of the danger from tigers. Bhorghur lies about 5 miles to the westward of Shapoor which is on the main road. It was with considerable difficulty that I could get any Goand to accompany me to the summit, the refusal proceeding from a fear of bears, whether real or pretended I do not know. There is a stone tank on the summit which contains water until the end of January ; after that month none is procurable nearer than 3 miles. The summit of the hill is quite bare of trees and jungle, and is composed of enormous masses of embedded granite.

From the commanding situation of this hill, rising to the height of 1500 feet above the plain, there will be a great choice of peaks in every direction. ...

The obstacles to carrying the meridional arc...are few and easily surmounted, and...I have seen no difficulties at all equal to those which the survey encountered in 1821 between the

[1] Geo. Everest (32–5). [2] Gāwilgārh fort, 55 G/7 ; *Imp Gaz.* (193). [3] petty provision merchants.

Godavery and Ellichpoor [232]. ... The route I have pointed out will be...greatly preferable to the plan of carrying up the meridian of Carangooly to Nagpore [226]. ... The country to the north of Nagpore is still wilder and more savage than between Ellichpoor and the Nerbuddah, without having the advantage of proximity to military stations and great roads[1].

The resumption of field work was delayed by a return of the fever which was to haunt Everest persistently for the next two years ; it was only his overmastering determination that enabled him to carry on and reject advice to take sick leave.

All now seemed again propitious and promising when, about the 20th of August, I had a smart attack of bilious fever, owing to too much labour of computation, which rendered the use of mercury necessary. I got the better of this in a few days ; but mercurial pills were given me as a constant dose, and one morning, having been overtaken some miles from home by a violent shower which wet me through, I found myself on my return again rather feverish.

The evening of the following day (September 3rd 1823) is one of which I shall carry the remembrance with me to the grave. I was seized suddenly with an uneasy sensation in my loins ; and on the following morning a very violent pain in all my bones, accompanied by typhus fever[2], shewed that the embers of my Yellapooram illness had only been smothered for a time, to burst out more formidably [232]. ... For six months after this I was never able to lie in any other position than on my back, and even then, if my sleep exceeded the period of three hours, I was awakened by one of these convulsive paroxysms, attended with an agonizing pain. ...

The medical gentlemen...at Hydrabad insisted on...my proceeding immediately to the sea-coast ; ... but I had made up my mind...that now or never the question was to be decided whether the Great Arc should be carried through to Hindoostan, or terminate ingloriously in the valley of Berar. ... If I had gone to the sea-coast at such a crisis, the work must have been suspended, the establishment would have become disheartened ; the greater part, or the whole, would have returned home, and perhaps never have rejoined me, for they were already at the limits of their native Deccan. ...

But it was a desperate resolution ; for my limbs being in a great measure paralysed I was in the unpleasant necessity of being lowered into my seat at the zenith sector, and raised out of it again, by two men, during the whole of the observations with that instrument. At the great theodolite, in order that I might reach the screw of the vertical circle, ... frequently...I have been under the necessity of having my left arm supported by one of my followers ; and on some occasions my state of weakness and exhaustion has been such that without being held up I could not have stood to the instrument[3]. ...

Finding by the 18th October that I could bear the motion of a palanqueen, I quitted Hydrabad...in company with Mr. Voysey, and marched along the high road to Karinjah, a large town in the neighbourhood of which is a station Peelk'her, one of those beyond which the operations of 1821 had not been successfully carried [232 ; pl. 18][4].

The first task was to select suitable stations to close the sixty mile gap south of the base at Tākarkhera which De Penning's party had left two years before ;

For want of knowledge of...the enormous increase of night refraction [235, 249], the party then employed had established a station called Donud, about eight miles off, because they could not see beyond it in the evening, but I had sent on a party to light a pair of bonfires at two o'clock in the morning (that being nearly the period of the maximum) at Budgaon [pl. 18], which is the land they are anxious to see, ... and...about that hour I was awoke by the people whom I had set to watch, exclaiming that the fires were clearly visible.

I had given written instructions to Mr. De Penning from Hyderabad to explore the land well on which my station of Badali was situated, and select the most eminent point, which the party engaged in 1821 had failed to do. This he accomplished very satisfactorily[5], and thus two of the main obstacles to forming the connexion...were obviated.

The final station connecting Tākarkhera was selected with the help of Voysey ;

Certain points in the mountain range, which could be seen everywhere, being known in respect to their distances from each other, as well as from the ends of the base, I instructed him to measure with a sextant from the back of an elephant the angles between any three of them, and when these angles had certain values, to fix on three or more elevated spots within these limits. ... He accordingly chose three such spots and ordered double fires to be lighted at each on successive nights, which were carefully looked for at stated hours by persons placed by me at each end of the base ; and the third of the three, Yaholi, having answered the purpose, the connexion was formed without further difficulty.

[1] DDn. 91 (315), 15-7-23. [2] Surely *malaria* ? [3] This has elsewhere been wrongly told of Lambton. [4] Geo. Everest (35-41). [5] joining from Nāgpur early in November.

I have made it a rule generally to observe by night ; in which case I have always taken the vertical angles about three o'clock in the morning, because I think that method gives the fairest chance of overcoming the errors of terrestial refraction[1].

Leaving Olliver to observe at the last four stations, Everest took astronomical azimuths and zenith distances at Tākarkhera [253], and then connected both ends of the base to the surrounding stations. He now lost Voysey and De Penning who both resigned early in 1824, and he was left with only two trained assistants, Olliver and Rossenrode. Nothing daunted, and in spite of constant ill-health [403–4], he worked steadily across the Gāwilgarh hills. By May he had selected stations so far forward as Tek, west of Pachmarhi, and then sent Rossenrode forward to select stations in Bhopāl [pl. 17].

Operations were greatly facilitated by the good offices of an old friend, Captain Robert Low, "Assistant to the Agent to the Governor General for the Nerbudda districts" with headquarters at Betūl, to whom Everest writes in August ;

I shall quit the vicinity of the Betool district tomorrow, and as my own escort is now of sufficient strength to enable me to dispense with the guard which you were so obliging as to authorize, ... I have ordered the whole party to return. I shall still have two stations within ...your jurisdiction occupied by my flags and lights for some time to come, ... and I will be thankful to you to afford the parties...all the protection they may stand in need of. Each of the...stations is marked with a stone, on which is engraved a circle and a centre. A list of these is enclosed, and in consideration of their extreme importance to my operations, I will beg...you to take such measures as...may...prevent their being...meddled with.

Permit me...to return you my warmest acknowledgement for the very kind assistance which I have experienced from you. ... It was at one time supposed that this mountainous tract would have formed an insurmountable barrier to...the Great Trigonometrical Survey, and...the prospect wore a very formidable appearance, for, notwithstanding the commanding features of the country, ... there would have been no possibility of remaining at the summit of any one...for 24 hours together had my supplies been at all deficient[2].

Leaving observations in Bhopāl to be taken later, he pushed on to reach Sironj early in November and spent the next three months measuring a base[3], and connecting it to near-by stations, besides taking astronomical observations at an observatory which he established at Kaliānpur about 10 miles to the west. Olliver was sent to select a station to the north and build the usual platform ;

You will proceed...to Surakho, and there examine the station and the ground about it. ... If the point already selected does not answer any other purpose than to transfer the base, you must try to get a station which will serve to carry on the principal triangles without spoiling their regular and symmetrical form[4]. ... It is my wish if possible to continue the series on the east side of the meridian [77° 30′], in which case the station you select must have a view of Bhowrassa, and either Kosan or Kamkhera [pl. 17]. ... It is always an object to keep near the meridian, but I should prefer going some distance from it to having the symmetry of my triangles injured. ...

The day that you arrive at Surakho, ... be so good as to sink a stone about 3 to 3½ feet long into the ground to a level with the surface, and give orders for preparing another stone to be placed duly above it, as also for collecting bricks and chunam[5] to raise a small pile of masonry to the height required for the instrument. Mark out the foundation 3½ feet in radius, and set people to work upon it, ... leaving a hollow in the centre for you to adjust the upper stone[6].

At the end of January Everest returned to observe at Rossenrode's stations to the south, writing to the General Officer commanding at Saugor ;

My preparations are all made for carrying on the remaining triangles through the territories subject to Bhopal and Bhilsah, and a little more than a month will be required, ... but if by any accident I should be prevented from accomplishing it now, it is impossible to foresee what may happen. Every one of my principal stations is marked with a circle neatly engraved on a stone, and if one of these should be moved, however slightly, the whole work must be commenced *de novo*. ... Instances of the removal of these central marks have occurred on more occasions than one, and given rise to great confusion [415][7].

By the time observations were closed at Bhaorasa[8] at the end of March, Everest had decided to follow his doctors' advice, and take leave to Europe for the recovery

[1] Geo. Everest (41–2). [2] DDn. 172 (164), Aug. 1824. [3] completed 13–12–24 [249–50]. [4] Station selected Surental [pl. 17] or Surantal, 1802 ft., 10 m. N. of Sironj. [5] lime. [6] DDn. 172 (293–4), 12–1–25. [7] ib. (299), 18–1–25. [8] 20 m. E. of Sironj.

of his health[1]. He still required about two months to complete his charts and angle books, and begged that,

as my reputation as a man of science is most intimately connected with my late operations, ... I may...take full and complete copies of my whole work, in order that the scientific results may be calculated by myself, and submitted when entire to the Hon'ble Court of Directors [256–7][2].

He reported later to the Surveyor General that his field work was

brought to a conclusion on the 26th ultimo (March). My health was by this time considerably impaired, but I had no apprehension that the inconvenience I felt arose from any other cause than fatigue, and accordingly I pursued my original intention of proceeding to Goonah[3], where I expected to be able to bring up my work more quietly, and at my leisure, than at the military cantonment of Saugor. But, on the 30th of the month a return of my disorder took place, much more violent than any...before...and, on my arrival at Goonah, I was in a most alarming state, and nearly deprived of all power of motion[4].

Two weeks later he forwarded his chart of

the 6th and part of the 5th section of...the Arc of the meridian[5]. These operations, with the measurement of a base at Sironj, the observation of near 400 stars near Takalkhera, and near 500 at Seronj, for determining the celestial amplitude, and the comparison of the chains, have occupied me since the end of November 1823 [252–3].

Not feeling capable of further effort in the way of computations, he closed work and left for Calcutta before the end of May[6] [241];

The establishment...were employed in the month of April, and part of May last, in making the rough calculations depending on my late operations, and in tracing two plans of the series of triangles. ... On the 21st May I detached my 2nd sub-assistant and the greater part of the establishment to Sagur, to place themselves under the orders of Captain James, D.A.A.G. at that station[7]. Mr. Rossenrode received instructions from me to proceed, as soon as the weather was favorable, from my late points Bhowrassa and Gurhguja [pl. 17], and carry on a series of secondary triangles so as to determine the position of Sagur. ...

I proceeded myself with Mr. J. Olliver, my native writer [256], and a party of my escort, on the 25th May towards Cawnpore, where I embarked with the public records and documents on the river on the 4th July, and reached Calcutta on the 12th August. ... I...enclose a...receipt for such of the instruments as were deposited...at Agra in a *very secure and dry place in the Armoury*, as also a list of those who accompanied Mr. Rossenrode to Sagur. ...

Not having found my health improve, but on the contrary my disorder daily gaining ground since my arrival at the Presidency, I have been under the painful necessity of obtaining a medical certificate with the view of proceeding to Europe[8].

Leave was granted[9] and the Directors informed that he had been allowed

to go to England on account of the bad state of his health, and the valuable services rendered by him are brought to the Court's favorable notice. The operations...have not been suspended as Captain Everest requested[10]. The direction in which the establishment will, ... be employed under the control of Mr. Olliver, senior sub-assistant, is explained in the Proceedings [241–2]. ... An indent...for new instruments is transmitted, with a request that Captain Everest may be consulted in their construction [260][11].

During his four years in England Everest worked up the results of his work and published them in 1830, at the expense of the Directors, under the title of *An account of the Measurement of an arc of the Meridian between the Parallels of 18° 3′ and 24° 7′, being a continuation of The Grand Meridional Arc of India, as detailed by the late Lieut.-Col. Lambton in the Volumes of the Asiatic Society of Calcutta*[12].

TECHNICAL DETAILS : LUMINOUS SIGNALS

Of the many changes which Everest introduced, none was more far-reaching than that of observing to lights at night instead of to flags and beacons by day. As has already been described, this had two very great advantages over the old system [235]. First, it took advantage of the increased refraction at night, which

[1] DDn. 201 (53), 5–4–25. [2] DDn. 171 (322–3), 2–3–25. [3] Guna, 50 m. NW. of Sironj. [4] DDn. 172 (348–50), 25–4–25. [5] pub. 1838, scale 8 m. to inch, *Ben Regr.* 588 (29). [6] DDn. 171 (347) 9–5–25. [7] Wm. James (1785–1855) Ben Inf., D.A.A.G. Saugor from 28–1–25. [8] DDn. 171 (354–6), Chowringhee, 3–9–25. [9] BGO. 14–10–25. [10] in letter to SG. of 5–9–25 ; DDn. 171 (359). [11] B to CD. Mil., 21–11–25 (16–21) ; DDn. 217 (153). [12] freely quoted in this account under the reference "Geo. Everest".

made it possible to observe much longer rays ; and secondly, it became possible to observe right through the open season, instead of waiting for the unhealthy months of rain. "There is another great advantage ; in the rainy season the inhabitants are all engaged in cultivating their fields ; in the hot weather they are all idle and glad to get employment for hire". The following is a letter from De Penning, who had not been on the western branch with Everest when the vase lights were first tried out [235] ;

The new method...for burning lights is really a very valuable acquisition to the Survey, and...a very cheap and correct mode of taking night observations. It is cheap, not only in itself from the materials used [248], but from the advantage...during bad weather, as the angles could be observed during the night, and thereby render it unnecessary for the whole... party to remain pent up for whole fortnights on the top of some elevated and unhealthy land.

The construction is truly ingenious and extremely simple, and greatly preferable to blue lights, since it can be seen at the distance of 40 miles and upwards in fair weather[1].

Blue lights were still useful in thick weather, and Everest tried to get them maintained as an article of military store ;

I am out of reach of all supplies. The Berar district can furnish none of the materials requisite for making blue lights, and I must carry an adequate portion of them with me. I must also have a blue-light compounder at hand, and indeed it has been by the dint of mere good fortune that I have fallen in with such a person[2].

It was usual during the life time of the late Lt. Col. Lambton to depend upon daylight for all observations, and, as it is only in peculiarly fine weather that distant flags can be observed it had become of late years a practice to carry on...almost entirely in the rainy season.

The dreadful misery and sickness which hence arose is a painful and feeling source of recollection. I have seen the ground strewed with the wretched followers, some of whom were left for want of means to convey them away to perish in the jungles, and I have myself deeply paid the penalty by the destruction of a strong and robust constitution, which had previously borne me through every privation and hardship [231–2].

When I came to the head of this survey, I determined to alter this system altogether, and, having by...a fortunate accident discovered the power of the vase lights which I at present use, I introduced them...into constant practice. The expence has been certainly greater, but ...I can now carry on...at any season of the year, and need never be in danger of witnessing or causing the scenes of...distress that formerly occurred as an ordinary annual affair.

The vase lights are of a very simple construction, requiring only oil and earthern vessels, and they can be distinctly seen in very dim weather at the distance of 20 miles with the telescope of the theodolite. They will penetrate through the common mists of the hot weather at the distance of 35 miles, and in very clear weather I imagine will be seen at 50 miles. When not agitated by the wind they give exceedingly correct observations, but furnish a much more clearly defined mark for intersection than any flagstaff will ever do.

Their power fails in long distances if the weather be dim, and then it becomes necessary to force a passage through the mists by means of blue lights, the luminous matter of which I should estimate to be 4 times as radiant as that of the vase lights. ...

22 blue lights are required at each station where they are blazed, and as they do not spoil from keeping unless exposed to moisture, I should imagine that a sufficient supply might...be made up in the Agra magazine and furnished on my indent. ... The blue lights which I use weigh each 1½ seers, and...160 will be the proportion for a camel[3].

These articles are only required to penetrate the dry vapours of the hot and cold weather in distances exceeding 25 miles. ... It sometimes happens that all my angles are completed in 24 hours...which, had I depended on daylight only, would have detained me 8 or 10 days, and perhaps forced me at last to quit them in despair. ...

Native receipt for blue lights.

If the composition be divided into 739 parts, the proportion for each ingredient is as follows, viz. ;

gunduk	.. sulphur	.. 136	*neel*	.. indigo	20
shora	.. nitre	544	*shungruff*	sulphuret of mercury	3
hurtal	.. sulphuret of arsenic	32	*ood*	.. gum benzolin	2
kaphoor	.. camphor	2			

Each blue light ought to weigh 1½ seers, or 3 lbs. The form is cylindrical, being 14½ inches in the length and 2¼ in diameter. The covering matter used...is as follows :—paper 3 layers —coarse cotton cloth 2 layers—sheep's bladder 1 layer.

[1]DDn. 91 (263), 19-11-23. [2]DDn. 171 (180), 11-4-24. [3]cf. Everest (104) ; to SG. DDn. 91 411) June, 1824.

Great care should be taken to prevent the matter exploding in the shape of stars which, however desirable in fireworks, are extremely inconvenient for observation. The composition is simply pressed into the paper cage. What might be the effect of driving it hard with rammers & a good mould, as is done with portfires and fuzes, I am unable to say. ...

For the current year 176 will probably be required. These should be sent to Seronj so as to arrive before the end of January[1].

Both blue lights and vase lights were still of occasional use twenty-five years later, when the more powerful reverberatory lights were not at hand ;

Blue Lights are very powerful and can be seen at distances of 50 or 60 miles. They are also useful in hazy weather when other signals are not visible ; if not carefully sheltered...by grass screens the flame is liable to be blown aside. On this account it was the practice of Colonel Everest to burn them behind an iron screen, in which an aperture cut was centred over the mark. The blue light fastened on the end of a stick was held...behind the aperture.

Blue lights being expensive articles cannot be kept constantly burning, but are fired at regular intervals. They are usually cut in lengths to burn about four minutes, and are fired at five minute intervals, which enables the observer to read off the observation, and also to observe and read off the referring lamp. At every second or third blue light a longer interval, of say 10 minutes or ¼ of an hour, is allowed...for changing zero.

Blue lights are always taken against a referring lamp, one station at a time[2].

Vase lights were invented by Col. Everest nearly 30 years ago [235]. The vase light consists of a common earthen dish about 10 inches in diameter, and filled with cotton seeds and common oil. This is placed on the mark, and, to prevent the flame being blown aside, a large earthen pot, in the side of which an aperture has been cut, is inverted over the dish. An aperture is also cut in the top to allow the smoke to escape. Further protection is necessary from high wind by means of grass screens and blankets, leaving merely the requisite opening in the direction of the observer. The materials for this light are procurable in nearly every village[3].

Olliver describes the working of his signals on the Calcutta Longitudinal series ;

The chief mode of taking the angles of the primary triangles is by oil burning at the several stations, and the observations made at night. This is a mode introduced by the Superintendent as being less subject to error, and beyond a shadow of doubt is far preferable to day observations, even in the most favourable time of year. ...

The Sub-Assistants inspect the fixing of the mark stones ; they at the same time also fix pegs in the several rays of the surrounding stations as a guide for the flag lascars to place the aperture of the vase which is used to screen the light from the wind. It frequently happens that I am detained an uncommon length of time at each station during the hot months. Owing to the state of the atmosphere the flags are not sufficiently discernable for observation, being at distances of from 25 to 40 miles, nor are the lights seen in all directions at the same time. Often...I was able to finish the observations to a part of the stations in two or three nights.

When these difficulties occur, the sub-assistant and myself relieve each other for several nights together till ultimately recourse is had to blue lights at those stations, in which case a sub-assistant is despatched to inspect the burning of the blue lights at stated times by a chronometer, he being furnished with a written memorandum of the intervals of each. ...

It is also worth reciting a most serious disappointment I experienced during the last trip. ... When I was at...Saugor, I availed myself of the opportunity of using the Great Theodolite, deposited in the magazine there [259], ... for its powers are far superior to the instrument in use [259–61]. ... As the distance was about 39 miles, I had recourse to blue lights for the angles. ... Though the blue lights usually burn for five minutes, I was able to see them for three minutes with the telescope of the Great Theodolite with sufficient light to see the wires at the same time, whereas a person watching with the other instrument could but just discern them only for one minute through the dark telescope.

After the blue lights, and by way of experiment, I also tried the vase light at the same place ; it was seen sufficiently distinct for observation only with the telescope of the Great Theodolite. ... I was able at another station to use the lesser instrument and, the distance being about the same, was able to take my observations with the vase light. ...

When I had to observe the third angle in the triangle, I was detained an uncommon length of time, and never once had a glimpse of the vase light during 16 nights, and ultimately, though I even tried the blue lights, I was not able to see it with...the wires at the same time. ... This was certainly a sad disappointment, and the consquence was that I was induced to abandon that

[1] DDn. 171 (271–6), 20–9–24. [2] These precautions were probably not all in practice before 1830.
[3] Thuillier & Smyth (396, 398).

station and adopt another. ... I dare not venture to use a supplemental angle in the primary triangles. So much is the want of a telescope of sufficient power felt in this splendid work[1].

REFRACTION

We have already referred to Lambton's interest in the mysterious variations of refraction [II, 259–60], and Everest's discovery of the remarkable increase that took place after sunset [235]. We have noticed how perplexed were the surveyors as to the correct allowance for computing heights of the snow peaks [II, 86–7; III, 48]. Everest records that comparison between wet and dry thermometer bulbs, as a measure of humidity, was first suggested by Voysey;

The late Lt. Col. Lambton's intended experiments of applying the Hygrometer to the determination of...celestial and terrestial refraction seem never to have been carried into effect. I do not indeed remember any hygrometer...in the late Lt. Col.'s possession, excepting one of those constructed by Captain Kater which after...a short time...was found...useless.

My late lamented friend, Mr. H. W. Voysey, when he first joined...in 1818, suggested...an ingenious mode of determining the...evaporation by applying a piece of wetted muslin over the bulb of a thermometer during the time of observing terrestial vertical angles, but I cannot find...any records of this having been introduced into practice. ... I was never in the field without that gentleman until the year 1822, and it was not until the latter part of...that season that I thought it might be of use to introduce the above practice. The first observations recording the wet and dry thermometers bear date Netoli the 13th Jan. 1823, and since that period they have been continued with as much regularity as circumstances admitted. ...

In regard to Refraction in general, there are no regular documents in my office recording observations made upon this subject by the late Lt. Col. Lambton. There are some loose and disjointed memoranda in an old box[2].

BASE-LINES

The length of Lambton's base-line at Tākarkhera, near Ellichpur, was about 379 chains, or over seven miles; the height of the south end was made 1226·9, and of the north end 1289·4, feet above the sea. Measurement was commenced on 6th January 1822, and, writes Everest, was made on the ground;

the chain was stretched out by two small wooden capstans placed one at each end. The register heads were fixed on to plates of lead, ... imbedded into the earth, and the vertical angles...were determined, as usual, by a transit instrument...exactly in the alignment. ...

This method of measurement is remarkable for its simplicity, but is...objectionable on the two accounts; that it is not in nature to present a perfect flat other than in stagnant water; and that the tension of the chain cannot always be the same when drawn out by the force of the human arm applied to a capstan. But Colonel Lambton called these objections absurd and pedantic, and used to say that any errors...which could thence arise would be insignificant in comparison with those which are inseparable from celestial amplitudes[3].

The length of the measuring chain was carefully compared with that of the standard chain both before and after measurement. The length of the standard had been ascertained by comparison against Carey's 3-foot brass scale at Hyderābād in June 1821 by the same means as used at Bellary in 1813 [II, 257], and a similar comparison was carried out at Sironj in 1825, when Everest charged for

a fabric of well-polished stone, 120 feet in length, and supported by 15 pillars 3 feet high, with square brass marks soldered in at 5 feet distance from each other, for...comparing the standard measuring chain with the brass standard scale[4].

The Sironj base was measured on coffers [II, 255] and was just over 384 chains long, and Everest records that he attended personally to every detail;

I laid every register head, and every coffer, and superintended the driving of every picket, myself; I took the precaution on every occasion to see that the weight acted freely on the

[1] DDn. 173 (28–35), 18–11–26. [2] to SG., Sept. 1824; DDn. 171 (284). [3] Geo. Everest (22, 128–9).
[4] DDn. 172 (295), 13–1–25; cf. Geo. Everest (51–2).

chain. I kept a constant superintendence over the thermometers, ten in number, and left no precaution unattended to[1].

The length agreed very closely with that brought up from Tākarkhera by triangulation, but there was a discrepancy of over 6½ feet between the bases of Tākarkhera and Bīdar[2]. This discrepancy was eventually put right by the re-observation of the triangulation between these stations during 1838–9. After computation of the northern section of the Great Arc, a discrepancy of over three feet was found between the Sironj base and that of Dehra Dūn. On remeasurement of the Sironj base with the new compensation bars, the measurement of 1825 was found to be 2·8 feet in defect, and on remeasurement of the Bīdar base in 1841 the discrepancy between Bīdar and Sironj bases was reduced to 0·36 feet. Everest was thus entirely vindicated in his condemnation of the chain for base measurement;

Foreign mathematicians have always protested against the use of the chain in delicate measurements, chiefly on account of the difficulty of giving it, at all times, an equal tension—the impossibility of accurately ascertaining its temperature—and the difficulty of preserving the joints from rust. ... The precaution of stretching the chain by a constant hanging weight was not always attended to by Lt. Col. Lambton. ... He sometimes measured whole bases with capstans managed by hand to stretch the chain, ... so here we have prevailing the very 3 causes most likely to be dreaded as origin of error[3].

Everest further points out that, in spite of Lambton's recomputation of all his earlier work in terms of the latest values of British standards [II, 262], it was impossible to determine the actual value of his unit, which varied continually;

There are two steel chains, ... one...used as a standard, and the other for measurement, ... but in consequence of the effect of rust and friction the lengths of them have altered, and frequent comparisons with the brass standard scale have become necessary. ... The means we have in India of performing these very delicate comparisons are inadequate; ... besides this, the brass standard scale requires to be compared with the latest parliamentary standard[4]. ...

The length of the chain reserved as a standard was originally known only from the statement of the late Mr. Ramsden to the effect that he set it off from his bar at...50° Fahrenheit and, as this mode of setting off was avowedly rude...in comparison with more modern methods, ...it followed that even in the outset there was a source of uncertainty. ...

Intermediately, owing to want of due precaution, the joints had become thickly covered, and in fact eaten into, by rust, in...clearing away which the length of the standard of reference was lost for ever [II, 257 n.5]. ... I am quite sure that...the exact lengths of all bases measured prior to and including, that of Beder, never can be referrible to the parliamentary or any other known standard. ... In 1825 I urged the expediency of sending the chain used as a standard to England, that it might be compared with the Parliamentary standard, but my recommendation was overruled. As a last resource I packed both chains in mutton fat, and left them to take their chance in the arsenal in Agra [26, 246].

On my return in 1830, one of my first inquiries was as to their fate, and they had had a very narrow escape indeed, for, independent of other causes of injury, I found...that permission had been given...to...Lieut. Boileau to use these very chains in the operation of certain route surveys[5]. ... I immediately withdraw this permission, of which fortunately Lieut. Boileau had not yet availed himself and, to prevent further accidents, directed both chains to be sent immediately to Calcutta. On their arrival, I found to my abundant satisfaction that the precaution I had used it packing had been effectual in preserving the steel joints from rust, ... and therefore that both must be in a state in which I had left them in 1825[6].

In discussing the possibility of recomputing Lambton's work [239] Waugh pointed out in 1849 that, with the loss of his unit of measure,

his work can never be uniformly combined with Colonel Everest's, in the sense that uniformity implies to the scientific world. The subject of a standard of measure was not understood in those days in the same rigorous light as it now is, nor were the same precautions considered indispensable. ...

Colonel Lambton's original standard was in fact a steel chain, an implement incapable of refined accuracy, owing to the impracticability of ascertaining its temperature, as well as on account of the wearing of the joint and stretching of the links. ... The joints became rusted,

[1] DDn. 342 (66), 28–12–37. [2] *Meridional Arc* (x, xli); *GTS.* VI, A-vii (xiii); DDn. 342 (66), 28–12–37. [3] DDn. 342 (66) 28–12–37; cf. Everest (132) & *GTS.* I (35–45). [4] DDn. 171 (322), 2–3–25. [5] Hardly fair; Boileau was to measure a base for triangulation, DDn. 220 (247), 1–8–27 [26 n.6]. [6] DDn. 286 (276–374); 30–8–36; para. 141.

and Colonel Lambton was so distrustful of its invariability that he resorted to a comparison with a 3-foot brass scale by Carey, the length of which was laid off by beam compasses.

Supposing that Carey's brass scale was in the first instance a trustworthy linear standard, which is by no means certain, as it is not known to have been authenticated by direct comparisons with other national standards, it is clear that the use of the beam compasses must speedily have destroyed its original pretensions to accuracy.

The difficulty appears to me to be insuperable, and the objection it involves will always attach to the old work, however carefully the computations may be revived[1].

HORIZONTAL ANGLES

All the angles observed by Lawrence and De Penning south of Pilkher [223–4, 232] were observed with an 18-inch theodolite which had a double conical axis for use as a repeating theodolite [III, 259], but, writes Everest,

that method, whatever advantages it may present in the measurement of one angle, is so very inconvenient when three or more points are to be observed, that it was never employed as such, though the zero point was changed for every 15 or 20 degrees[2].

Observations from Pilkher northwards to Sironj, and those of Everest's western branch, were made with the large 3-foot theodolite.

For the accuracy of his horizontal angles Lambton trusted to several repetitions, generally without change of face, and invariably on one zero only. He gave Everest the following instructions for working the great theodolite ;

The instrument was accurately adjusted at the Gardens[3] for reading from zero on the limb without the necessity of turning the telescope over, and the instrument half round in azimuth, because there is an error in the semi-circle which ought to be divided, and it will be more simple, and sufficiently accurate, to place the wire of the micrometer to zero on the semi-circle, *when* the telescope is perfectly adjusted, and the level is brought parallel to the line of collimation. This was all done at the Gardens with the greatest care.

The regular changing of zero was introduced by Everest to counteract the distortion of the horizontal circle caused by the accident of 1808 [II, 241, 254] ;

The restoration of the limb had been so successfully brought about that, between the readings at one part of the limb and those 90° from them, there was a difference not exceeding 26″, whilst the intermediate divisions agreed extremely well, and gave nearly a mean between the others. If, therefore, the zero could be changed a sufficient number of times, it was a fair assumption that the errors would be annihilated. ... I have arbitrarily assumed...nine times for the whole semi-circumference, by which means every twenty degrees have successfully come under the micrometers [258].

At each change of zero the angle has been observed twice, and in many cases four, five, or more, times, and the arithmetical mean of all the readings at the same part of the limb has been taken as one observation. ... But it frequently happens in observing by night (particularly with blue lights), that the angle is taken by parts by means of a referring lamp. In this case it has always been my practice in measuring the corresponding part, to bring back the limb to the very same reading which the lamp gave at the measurement of the first part, so that the inequalities of the limb...might be allowed to have as little influence as possible. ...

Of the success which has attended these precautions a judgement will be best formed from the columns of error in the table of the principal triangles ; and, as I...reject no observation which had been once made, ... whether...they differed widely from the mean or not, the general mean of them all is here given.

But, that no means may be left untried of exposing such errors as might still lurk, ... I have taken frequent opportunities of crossing the sides of my triangles diagonally in various ways, so that the...agreement of the sides common to each must furnish an all-powerful and irrefragable test of the degree of *confidence* to which the work is entitled. ...

In no case has any angle of my series been left unmeasured, and...the instrument has in every instance been placed over the centre of the station of observation[4].

Between Takal Khera and Kalianpur...I was in the field the whole time—I observed all the terrestial angles myself with hardly an exception—I measured the base of verification

[1] DDn. 462 (265–307), 15–1–49. [2] Geo. Everest (45). [3] the French Gardens, Hyderābād, Lambton's hdqrs. [II, 394 n.11 ; III, 223–4]. [4] Geo. Everest (47–9).

at Seronj almost unassisted—I took all the observations for azimuth and zenith distance at both extremities, and in the latter without relying for assistance on any person whatever.

The triangulation was performed entirely with the large theodolite[1].

The earlier work of Lawrence and De Penning to the south filled him with distrust [234] ;

I find on reference to the original angle books of...Mr. Lawrence mistakes frequently occurring. The means of the readings, as well as the angles deduced from them, appear to have been seldom or never rigorously examined by two distinct individuals ; the general mean is not drawn from the whole of the observations, but only from such as were selected *ad libitum*, and the excess or defect in the sum of the 3 angles, which in spite of all human care will always arise, is thus arbitrarily made less in appearance than in reality. ...

I may be told whilst thus criticising the performance of others to look at home, and that my operations...are just as liable to be faulty as those to the southward, but...as far as human care and caution could prevail, I have guarded against error—...none of the objections above urged apply to me, for...I have in no case arbitrarily rejected an observation, but have always taken the general arithmetical mean without selection or exception[2]—...I have divided the excess or defect aggreeably to the rule of probabilities—and...my angle books have throughout been carefully examined by two persons, and in great part by myself[3].

Where possible, stations were marked by cutting on solid rock [II, 267, 415] ; otherwise by a markstone [245], with suitable precautions as thus described by Olliver ;

When a station is fixed on a prominent detached hill, nothing remains...but the sinking of a heavy stone even with the surface, marking the position by inserting a circle and centre. ... On an extensive flat, it then becomes necessary, ... to raise a platform of stone...to a height sufficient to overtop the neighbouring flats. ... A sub-assistant should...fix a marked stone even with the surface of the platform when finished, taking care that the centre of the stone above should correspond with the center below, and in the event of it being necessary to have the platform uncommonly high, similar marked stones are placed between the upper and the lower as the work proceeds, and this is always done with the greatest possible nicety by means of a plumb line[4].

ASTRONOMICAL OBSERVATIONS

The astronomical observations regularly taken were—for azimuth to determine the meridian—for zenith distance to determine latitude, or differences of latitude[5]. Regarding azimuths Everest records that Lambton's common method

was to measure the horizontal angle between the pole-star at the time of its greatest eastern and western elongation and a referring mark, ... placed as nearly as could be done by conjecture in the direction of the meridian, the position of the lamp having been then ascertained relatively to one of the principal stations. ...

In...1822, when employed in carrying on the western series, ... it seemed to me...waste of time to wait ten or twelve days at a station merely to get a solitary observation at night ; for the pole-star is never observable in these latitudes at both elongations, except at that period of the year when the sun is below the horizon at the time of each phenomenon. ...

It appeared to me, therefore, that the best mode was to extend the same principle to other circumpolar stars besides the pole-star, and accordingly since that period my azimuths have been made to depend on the angles of greatest elongation of...the three stars in the Greenwich catalogue nearest the pole.* Not, however, without considerable objection on the part of the late Lieutenant-Colonel who, though he had too much good sense to overrule me, opposed what he pronounced to be an absurd innovation. I argued in reply that, unprovided as I was with any other time-piece than a common pocket watch, it was better to take as my guide the variations in altitude than those of the hour angle. ... The result has shown to my satisfaction that there is really no difference between the degrees of reliance to be placed on the azimuth, whichever of the three stars has been employed[6].

The relation between the angular difference of latitude as obtained by astronomical observation and the linear distance as measured by triangulation gave the

[1] SG. to Govt., 30–8–36 ; DDn. 286 (276–374), paras. 138–9. [2] Such acceptance of seriously discordant observations is not approved by all, *v. Cal. Rev.* IV (88). [3] DDn. 171 (359–96), 5–9–25. [4] from Olliver ; DDn. 173 (28–35), 18–11–26. [5] or amplitude of arc. [6] Geo. Everest (87–8).

essential data for determining the length of the degree upon the meridian, and for calculating the figure of the earth. To reduce to a minimum the effect of error and uncertainty regarding the places and movements of the stars as given in available catalogues, it was Lambton's practice to observe the same set of stars at each station. In observing at Tākarkhera, however, he overlooked the fact that the southern stars would no longer be available further north, and Everest had later to make a fresh set of observations to suitable northern stars[1];

A certain catalogue of chosen stars was made use of by the late Lieutenant Colonel Lambton at all stations, ... but when the meridional series was brought up to Takal K'hera, it appears that the declinations of those which had served in lower latitudes were now beyond the reach of the limb of the zenith sector ; and the few which were still within its limits drew the telescope up to so great a deviation from the zenith that the imperfections in the structure of the instrument became a prominent object of anxiety. ...

Had it been foreseen, ... nothing would have been easier than to provide against such a contingency ; but no provision having been made, it followed that the excellent method... of determining the amplitude by observing the same stars at both extremities of each section must either be abandoned, or else Daumergidda must be visited a second time, a procedure not only...exceedingly vexatious, but...well nigh impracticable.

It...remained to determine the celestial amplitude between Daumergidda and Takal K'hera by absolute latitudes ; a method doubtless objectionable, because the result is liable to all the errors of catalogues. ... In adopting this method it became necessary to recompute the corrections for Colonel Lambton's zenith distances both at Daumergidda and Punnæ ; the former because the Greenwich catalogue of 1802 (which had been used throughout...[256]) was inferior to the more modern one of 1830 ; and the latter, because the constants of aberration and nutation had undergone some alteration since 1809 and 1815.

It has, however, been an object to interfere as little as possible with the labours of Lieutenant-Colonel Lambton ; not only because it might be rather presumptious to correct what my venerable predecessor had deemed definitive, but because the latitudes and longitudes determined have been adopted in the formation of the Indian Atlas [282–6], and any change in one point would involve a corresponding change in all. And hence there will appear to be two sets of latitudes ; one...deduced from Lieutenant-Colonel Lambton's observations and reserved for geographical purposes ; whilst the other, determined by me, will serve as elements in computing the figure of the earth[2].

At Kaliānpur, near Sironj, Everest observed the same stars as he had at Tākarkhera[3], in a special observatory built for the purpose [234, 245] ;

To avoid the unequal attraction of the high lands, I was obliged to place the zenith sector in a very exposed situation, and the violence of the winds whish prevailed during the whole of this season has been such that the observing tent would not have afforded sufficient protection. To adjust this instrument with accuracy...the reflecting lantern which illuminates the wires should be protected from agitation[4].

FIGURE OF THE EARTH

A summary of Lambton's contribution to knowledge of the figure of the earth has been given elsewhere [II, 262], and a full account of the deductions made by him and Everest is contained in Everest's *Arc of the Meridian*[5] and in *The Account of the Operations of the Great Trigonometrical Survey of India*[6]. Whilst on sick leave in England Everest worked out new values

from different pairs of arcs in different parts of the globe. From this investigation he inferred that "the direction of gravity in hardly any part of the surface coincides with the normal", and consequently that small arcs were objectionable, ... being liable to be burdened with errors in the determination of their amplitude, which might greatly exceed the errors in the measurement of their length. He considered the most trustworthy of his comparisons were those obtained from the longest arcs, *viz.*, Punnæ-Kalianpur and Formentera-Greenwich. ... They made the semi-axes of the earth to be 20,922,931·80 feet and 20,853,374·58 feet respectively, and the ellipticity 1 ; 300·80. These, ... which are known as "Everest's Constants,

[1] *GTS*. XI (7). [2] Geo. Everest (1–3). [3] 372 observations at Tākarkhera, 388 at Kaliānpur ; in the end Tākarkhera base and zenith distances were discarded, and Bidar–Sironj treated as one section. [4] DDn. 171 (316), 12-2-25. [5] Geo. Everest (103–16). [6] *GTS*. II (125–7) & VI (1–7).

1st Set", have, since about 1830 to the present time [1870], been employed in all calculations of the Survey of India into which the elements...enter [II, 262][1].

Both Lambton and Everest were fully aware that there were unpredictable variations of gravity, both in force and direction, from one place to another, caused by visible masses above the general surface, or by unseen variations of density below [II, 241, 250, 261]. The investigation of such phenomena was to be one of the duties of the medical officer and geologist appointed in 1818 [225, 264–5];

In almost all the admeasurements...made in various countries and under different latitudes, perplexing...instances have been observed, where the result has not corresponded with that progressive diminuation of each adjacent degree which is indicated by the spheroidal theory of the Earth's figure. For these embarrassing variations scientific men have assigned different causes, but the prevalent notion...seems to be that...the plummet is affected...by the nature of the strata beneath the Earth's surface. It has consequently been suggested...that the nature of the strata should be accurately noticed, and that frequent mineralogical sections should accompany and correct the labours of the trigonometrical surveyor[2].

Everest was particularly struck by the possibility that the Mahadeo, or Gāwilgarh, hills, lying north of the valley of Berār [242–3], might affect observations;

In the early part of 1822, when I returned from the Cape of Good Hope, my first remark on arriving at the camp at Takal K'hera was that...the existence of a formation of such density and magnitude would cause a considerable deflection of the plumb-line ; but on my mentioning my doubts to Colonel Lambton, he only laughed at them in a sort of compassionate way, and said that the mountains were much too far off to have any such effect.

The habitual respect which I felt for the Lieutenant Colonel's opinions made me very diffident as to the validity of my own ; and though not convinced I was silenced for the time.

He worked out the effect that the general mass of these mountains might have, and found a possible deflection of the plumb-line at Tākarkhera of between 4″ and 5″ which he claimed to be within one second of the deflection indicated by measurement of the section of the arc to the north[3].

He was fully aware of the possibility of measuring variations of gravity by means of pendulums, but had no suitable apparatus ;

If the rate of a good clock can be accurately determined in two or more...latitudes (the length of the pendulum and arc of vibration remaining the same), we may determine the increments of the force of gravity, but, in order to obtain the necessary elements, a numerous and well selected set of transits must be taken. In this I am now occupied, but, as the state of my health will not admit of my sitting up during the whole night, I am obliged to entrust the transits which came later than 1 o'clock to my senior sub-assistant, Mr. J. Olliver[4].

To Blacker's suggestion that Lambton may have made similar investigations, Everest replied in July 1824 [240] ;

The late Lt. Col. Lambton had often expressed his intention of making...a series of such experiments at all different stations on the Great Arc [II, 250–1 ; III, 239], but I believe that none were ever made, and that the only series of regular observations in the department tending to this point was made by me at Takalkherra in February last. ...

There were no instruments in the possession of the late Superintendent suited to this purpose except the Earnshaw clock [260], but the clock...had never even been adjusted to sidereal time until it came into my hands, and previously to that period had always been used as a mere solar time-piece. ... No instruments have ever been supplied by the State for the purpose of determining the length of the pendulum or the increments of gravity, and altho' there is every reason to believe that applications have been made by the late Superintendent for one of Kater's pendulums, yet none was ever received[5].

Everest was not aware of the observations in progress at the Madras Observatory. The use of the pendulum for determining variations in the force of gravity, and the corresponding determination of the length of the seconds pendulum at various latitudes, was being pursued at this period by Kater and Sabine [II, 410–1 ; III, 191][6]. One of Kater's "invariable" pendulums reached Madras in March 1821, and from his first observations Goldingham reported two months later an ellipticity of 1:297·56[7].

[1] James Walker, *GTS.* II (127), XI (7). [2] from MS. to GG. to Mil. Dept., 25-10-17 ; DDn. 64 (67). [3] *GTS.* II (127) ; Geo. Everest (93–104). [4] DDn. 171 (160), 6-2-24. [5] ib. (216), 7-7-24 ; cf. Everest (51, 56–62). [6] *Roorkee Papers* IV (97–108) ; Sabine's pendm. obsns. 1822 extended from Bahia, W. Africa, 12° 59′ S. to Spitzbergen, 79° 50′ ; Paris ; Greenwich, 1827–30 ; *RS. Progs.* LI, 1892 (xliii). [7] *Phil Trans* 1822, part I (127–67).

He then organized a party to take observations "for finding the length of the pendulum at the equator", and on the advice of Sir Stamford Raffles [II, 473] sent it to the islands lying off the west coast of Sumatra.

Two experienced assistant surveyors, John Robinson [II, 141–6, 352] and Peter Lawrence [II, 346, 351 ; III, 379], were to make the observations; two British warrant officers held charge of the stores, and they had a *tindal* and nine *lascars* to help. For charge of the expedition Goldingham asked for an officer with "a regular scientific education, ... with a habit of overcoming difficulties... and a power of command". He was given John Crisp, who had been at the Military Institution [II, 321], who attended the Observatory for preliminary training.

The party embarked on the *Morning Star* on the 13th March 1822, and after a passage of 34 days landed at Fort Marlborough near Benkulen on 18th April. After preliminary observations there, they spent June and July sailing from one island to another in search of the one nearest to the equator. They suffered storms—earthquakes—sea-sickness. By December they had fixed on the island of Gaunsah Lout[1], but two months later had a visit from

three of the savage inhabitants of these parts, who came here under the pretence, or for the purpose, of fishing, got into the large tent, and took from thence the transit instrument, azimuth compass, circumferentor, and a small box belonging to Captain Crisp, thinking, as it would appear, that the brass parts of the instruments were gold.

Fortunately the survey was already completed and the pendulum apparatus was not touched. On the 13th February Robinson and Lawrence commenced observations with the pendulum, each taking separate sets. These were completed by the 20th March, as well as those for latitude. After observations at other points, they re-assembled at Benkulen on 9th April, and arrived back at Madras on 4th June 1823. After checking and analysing the results, and "by combining the London with the Madras experiments, and taking the length of the pendulum at the equator deduced from the Gaunsah Lout experiments", Goldingham found the ellipticity of the Earth to be 1:296·61. Lawrence's training under Lambton had not been in vain [II, 346 ; III, 378]; his observations were "very numerous, and so good that very few indeed were rejected on account of...differing from the mean". Robinson's results were not so good.

Goldingham's published report[2] gives full details of all observations and their computations, with a most interesting account of the expedition, and maps and views of the islands and coast of Sumatra[3]. Particularly interesting is a coloured sketch of the island of Gaunsah Lout, shewing the observatory and encampment—four Englishmen in felt hats, blue coats, and white trousers—heavy trees and large tents. "This island is 365 feet long by 200 feet broad and is about 11 feet above low water. Tide is 9 feet rise and fall. ... Well of fresh water 7 feet deep"[4].

Everest took part in some pendulum experiments whilst in England during 1829, and brought out a pair of Kater's intruments, but never found opportunity to use them.

COMPUTATIONS AND REPORTS

Lambton's general view was that every 4 months in the field required 8 months indoor work [237]. At the time of his death there were heavy arrears of such indoor work both for the Great Arc and for Everest's "western series", and the computations and reports had to be closed by Everest [256]. During 1823 De Penning was occupied at Nāgpur with the computation of his own triangulation, and of Lambton's observations at Tākarkhera;

The errors...in my calculation of Polaris arise partly from the differences of our Tables, and the mode of calculation adopted according to Col. Lambton's instructions. The Table we

[1] lat. 0° 1′ 48″·6 N.; long. (Goldingham's) 98° 47′ E. [2] Goldingham (1–268) ; GBO Lib. Ffi 126. [3] ib. (pl. 16) geogl. map, 16 m. to inch, shewing all places visited from 0° 35′ N. to 3° 40′ S. [4] ib. (pl. 11).

have in the office for the stars is of a very early date, ... to the beginning of 1800, ... [and] has been in use from the commencement of the survey [253]. But Col. Lambton lately gave me the right ascension, &c., of Polaris from a table of Zach's, ... the beginning of 1822. ...

The differences in the Tables...will induce me to suspend my calculation for the stars ...till I am favoured with further instructions from you, ... whether I am to use the tables as given in the Nautical Almanac for 1822. ... I humbly beg you will...favour me with some proper rule and examples for each of the stars to be corrected, ... for nutation, aberration, and solar equation for declination and right ascension. The correction for the latter were never applied by us. In the meanwhile I shall be going on with the secondary triangles[1].

Once field work was restarted in October 1823 there was little time for computations, and it was only with difficulty that Everest was able to meet the Surveyor General's request for copies of Lambton's reports. To a call for data for Madras topographical surveys he pleaded that his sub-assistants were

already overworked, and I have before me the measurement of a base line, the observations of zenith distances, transits, and circumpolar star azimuths, which will occupy me and all my people...from the beginning of Novr. until the end of February. When these are finished I have to carry down a series of principal triangles from Seronge to meet my old points on the Nurbuddah, and after that to proceed northerly to Agra[2].

He managed, however, to recruit a Bengali writer "on a salary of 30 sa. rs. in quarters and 40 when travelling", to help in copying the reports, and obtained sanction to the provision of an office tent of such size and dimensions

as to admit of its being pitched on the tops of rocks and mountains[3]. ... Without one, much time is lost because I cannot hold regular office in the field. I should not be so anxious... were I perfect in health, but as an invalid I require privacy, and cannot as formerly have the calculations made in my own tent[4].

He had made but little progress on these arrears before starting for Calcutta ;

The *Report* cannot be made out until...the calculations...are brought up. This will be the work of many months, and from the state of my health it is impossible for me to undertake it at present [246]. ... With regard to the unfinished Report of the late Superintendent, ... one copy is nearly written fair and only requires to be examined. Want of office assistance, and the activity of my late operations, have prevented more progress being made, as neither my time, nor Mr. Olliver's, could have been devoted to that object without losing the favourable season in the field. All the documents are under charge of Mr. Olliver, who as 1st Sub-Assistant is officially responsible for them[5].

Soon after arrival in Calcutta, he reported that

the 3rd and 4th vols....were forwarded...in January 1818 [II, 264]. The 5th and 6th volumes will contain...original data as well as the calculations drawn from them. ... One copy of that Report [5th] is completed, and remains only to be rigorously compared with the data and calculations. The latter were made during the lifetime of the late Superintendent, and have all...been gone over by two persons[6]. ...

The 6th volume is complete, all but the Article 230, Section 42nd, and the appendix[7]. The former of these being a scientific paper I had intended to reserve for a future examination. ... The appendix contains the alphabetical Table of Latitudes and Longitudes, ... as also the Elevations and Depressions. which have been calculated. ... The Plans connected with the work...will comprise all the operation between the Kistna and Godavery rivers. ...

The series on which I was engaged between the middle of October 1822 and the latter end of February 1823...was brought up as far as the neighbourhood of Sholapoor, but the confusion consequent on the death of my late master...rendered it impossible for me to proceed [236]. ... This series is particularly valuable...(even in its unfinished state), because it will unite the surveys made under the late Captain Garling with the Bedar base. ... The original data is all very complete, and all the corrections for the circumpolar star observations, 97 in number, on which the azimuths depend, have been accurately calculated by myself and Mr. Olliver[8].

He was allowed to take to England extracts and copies from his own observations, but the originals had to be left in the Surveyor General's office [246]. From these copies he worked up the account of the 5th and 6th sections of the arc

[1] to Everest 19-6-23, DDn. 91 (307-10). [2] DDn. 171 (284), Sept. 1824. [3] DDn. 171 (271), 20-9-24. [4] DDn. 204 (128), 15-12-24. [5] DDn. 93 (144), 20-5-25. [6] TS 5, sd. by Lambton ; issued and countersd. by Everest, 1832 ; *IO Cat.* (9) ; GBO. Comp. G 5/5, Q 1/5. [7] TS 6 ; contains appx. Everest's series 1822-3 ; Garling's triangles Raichur 1816-7, and W. border Nizām's Dominions, 1819-20 [117] ; issued and sd. by Everest 1839. *IO Cat.* (11) ; GBO. Comp. G 5/6, Q 1/6. [8] DDn. 171 (359), 5-9-25.

with the assistance of Richardson and Taylor[1] of the Royal Greenwich Observatory ;

To Mr. Richardson, in particular, my acknowledgements are due, for to him have been entrusted more than three-fourths of the computations, [the] greater part of which relating to purely geodetical subjects were yet new to him. ... He entered so enthusiastically into my views, listening so patiently to my explanations, and shewed so much persevering attention, ... that he has mastered all difficulties with as much facility as if the work had formed part of the business of his life. So much cordial good-will I never saw before, nor ever expected to meet with in a stranger: greater it is impossible I could desire to see[2].

The Directors had this book published and presented Everest with 40 copies for his personal use[3], distributing others to the Royal Astronomical, the Royal Asiatic, and the Geological Societies, and also to the British Museum[4] [246]. This authority was modified after the work had been printed : they had authorized

the printing of this report with a view to its publication as a part of the materials for the Atlas of India, an intention which we shall not fulfil, as we find from the preface, which was added after we directed the printing, ... that the materials of which it is composed are not of that complete and final nature which...should characterize all works connected with the Atlas. We, however, transmit two copies for...the Surveyor General's Office[5].

Before leaving India Everest directed Olliver not to issue any results derived from the meridional arc for which he considered himself personally responsible. Olliver was, therefore, much distressed when Hodgson pressed him for results from his longitudinal series ;

As the latitude and longitude of...Kullianpoor...have not as yet been definitely settled, I...felt a delicacy in producing any result from my labors. ... The final results of my labors, ... should be reserved...for the Superintendent...on the grounds of...his general parting letter, to the effect that in any arrangements that may take place after his departure...his interests be not forgotten, and that the scientific results depending on the meridional series be...exclusively for him to produce. The Superintendent...has explained all the causes for so reasonable a request, and I sincerely trust, in furnishing you with the traverse tables, etc., in full length, I shall be freed from incurring his displeasure[6].

INSTRUMENTS

An account has already been given of the instruments used by Lambton [II, 251–5]. Most of these were Government property, but a few had remained his own, and others which he had ordered from England on his private account reached India after his death [188 n.1, 260].

The principal are, 1st., a repeating circle of 18 inches diameter, for taking horizontal angles, with vertical circle of the same diameter—2nd., an astronomical clock—3rd., some articles on the way out, viz., an apparatus for applying to ends of the steel chain when measuring base-lines on the ground ; a new brass standard scale, with improved apparatus for reading off ; an instrument for determining the variation of the needle to great nicety ; six thermometers of the most improved kind for ascertaining the expansion and contraction of the chains[7].

Much confusion was caused by Dr. Morton's hasty action at Nāgpur, in selling several Government instruments, and some private ones which Lambton had specially purchased for the survey, which should never have been sold to outsiders [236]. In January 1824 Everest held the following ;

1 large three-feet Theodolite, for carrying on the principal triangles [II, 253].
1 Zenith Sector, for observing fixed stars [II, 252].
1 Circular Instrument, with Altitude and Azimuth Circles.
1 Astronomical Clock, with compensation pendulum.
1 small Transit Telescope, for the base line.
2 Steel Chains, with register heads, for the base line.
1 Boning Telescope, and 3 thermometers.
2 Standard brass scales.
1 Astronomical Telescope.
2 sets of Beam Compasses.
2 small Chronometers.

[1] Richardson, asst. at Royal Obsy. Greenwich, 1822–45 ; *v.* bio. notes ; Taylor succeeded Goldingham at Madras, 1830 [191 n.7]. [2] Geo. Everest (119). [3] Several distributed to Fellows of RS. ; Everest (4). [4] CD. Misc. 66 (1129), 69 (1244). [5] CD to B., Mil. ; 5–5– & 25–8–30 (1–3). [6] DDn. 173 (97), 1–8–28. [7] DDn. 144 (389–92), from Lambton to Pub. Dept. 28–10–19.

Additional instruments, belonging to the Quarter Master General's Department;

2 small Theodolites,	2 boxes of Drawing Instruments,
3 Gunter's scales,	2 twelve-inch parallel rulers,
1 Sextant,	3 Circular Protractors,
2 fifteen-inch parallel rulers,	2 brass 100-feet Chains, with pickets.

Unserviceable instruments; 2 barometer, 1 theodolite, a sextant.

Note.—1. In the return of instruments, forwarded...on the 8th October 1823, 6 thermometers were inserted by mistake; 3 of the six were broken in the public service in February 1822, and there are now only three in store.

2. In all the returns hitherto forwarded only one brass standard scale has been inserted. There are however two, one of which was received from the late Capt. Garling[1].

The Great Theodolite was used by Everest on his western series in 1822, and also on his later triangulation up to Sironj. On his return to Hyderābād after Lambton's death, he sent certain parts down to Madras for repair;

I prefer the fine-drawn silver wire to anything else, especially for the micrometer. ... The wire should be of adequate thickness to cover the dot on the limb, but the lighter you can put it the better. It is usual, I know, to use the fine golden cobweb which the spiders in these jungles weave most beautifully, but it is not so good for night observations[2].

The poor old instrument had a fortune escape two years later;

A very disastrous accident occurred here on the of the 10th, the consequences of which will detain me for some days. About 9 o'clock a sudden storm commenced, accompanied by hail and rain, and the violence of the wind was so great that nothing could resist it. All my tents were blown to the ground, and some of them were torn to pieces.

The large Theodolite was on its stand ready for observing, and was overthrown by the falling of its tent, though the latter was fastened by double ropes, and ten of my people were stationed to hold them. Fortunately it has received no other injury than the breaking of one of the lower screws which I have the means of repairing, but I lament to add that one of the beautiful Troughton barometers which stood in the tent was completely crushed, and that I have little hopes of being able to restore it without sending it to Calcutta[3].

Everest suggested that he should take it home with him for thorough restoration, but it was decided better to indent for new instruments altogether;

The large Theodolite met with a very serious accident...in the Tanjore country [II, 241, III, 239], from...which it never has recovered, and never can, without undergoing a thorough repair under the hands of a first-rate artist. The late Lt. Col. Lambton succeeded, it is true, ... in approximating it to its former state, but there have ever since been great irregularities in...the limb, and the angles taken with it differ so much *inter se*, that common accuracy is not to be obtained without frequently changing the zero [251].

In the best days of this beautiful instrument, 3 or 4 observations were deemed sufficient to determine an angles with correctness, and the zero was seldom changed above once, if at all; but since the crash that the limb received in the Dekhan[4] it has been found necessary to change zero 9 or 12 times, and to take a mean of 18 or 24 observations. ...

The different climates...have warped the mahogany stand and table, and upper frame, so much that it cannot be adjusted without great difficulty, and will hardly preserve its level for the space of 20 minutes. The delicate screws of the levels are all more or less out of order from continual use; the mahogany rim to which the lower clamp is fixed has in some places yielded, and the dots which mark the divisions are, from frequent cleaning and the effect of...dust, ... in some parts nearly erased, and in others entirely so[5].

It was put away in store at Saugor, and was once taken out by Olliver in 1826 [248]. Everest found it there on his return in 1830;

I recommended in 1825 that this old instrument should be sent to England to be renovated. It may be doubted, however, whether any artist of celebrity would have anything to say to such a procedure, for it was in a sadly ricketty condition and, as it was deposited at the time of my departure in 1825, so I found it on my return in 1830. ...

I had...familiarized myself with the finest instruments of the day, and gone through the workshops of the...most celebrated artists of civilized Europe; my taste...had undergone a thorough change, and my old acquaintance certainly did make but a sorry display. ... Its distorted limb, its wooden framework, ... patched up with an iron plate on which the marks of the original injury were still apparent; its mahogany 4-legged stand and table, cracked...and

[1] DDn. 171 (155), Jan. 1824. [2] to Geo. Gordon & Co., Madras, 22-5-23; DDn. 171 (46). [3] ib. (316), 12-2-25. [4] presumably on 10-2-25 (*sup*). [5] ib. (322), 2-3-25.

scarred from many a hard day's journey, all acted against its good looks, and it was a subject of surprise to me how I could have managed with an apparatus so crazy[1].

The wonderful old theodolite was renovated by Barrow in Calcutta, and then regularly used on principal triangulation until 1860, and is now an honoured exhibit in the Survey museum in Dehra Dūn.

The 18-inch Circular Instrument was obtained from the Madras observatory to replace a private one belonging to Lambton that had been sold to the Nāgpur Government. Lambton's instrument had been used by Lawrence and De Penning, and probably also by Everest on his adventurous work of 1819–20 ; for he describes it as "an old friend and fellow traveller" [II, 254 ; III, 229]. It was one of a pair ;

Colonel Lambton ordered from Carey an instrument which combined the advantages of the Theodolite and Zenith Sector, which he received in 1810 or 1811. ... A similar one was at the same time received by Colonel Munro[2], then Quarter Master General, and was by him disposed of to Government, and is now lodged in the observatory [II, 196]. ... The price is the same, the adjustment easy, and, as it combines every requisite for trigonometrical and astronomical observations, it renders any other instrument completely unnecessary[3].

As Lambton's instrument could not be recovered from Nāgpur, where it was wanted for Stewart's survey [91], Everest asked Goldingham for the twin ;

You will have heard...of the death of the poor old Colonel, and of the manner in which my operations have been embarrassed by...Mr. Morton, one of the Executors, ... who has sold off all the private instruments...employed in the service of Government [257–8].

I am, ... much distressed by the want of instruments and, calculating on your love of science, venture to apply to you. ... You have in your observatory a Repeating Circular Instrument, the exact counterpart of that...sold by Mr. Morton, furnished with two micrometers for the horizontal limb, and a vertical astronomical circle, also with two micrometers. It does not appear...adequate to your delicate observations, nor indeed to be at all the kind of instrument you require, but it is particularly well adapted to my purpose, so that, if you can possibly spare it to me, you will...do the greatest service to our establishment[4].

At the same time he made official request to the Surveyor General, 19th April 1823, and another through the Resident at Hyderābād, supported by a private appeal ;

I have made bold to address you in a public letter, and...there is some little irregularity in so doing. ... An application of this nature should by right travel along the broad highway of regular business ; ... it should first be submitted by me to the Surveyor General ; next by him to the Government through the Secretary ; then agitated in Council, & so forth. But, alas, hope delayed maketh the heart sick ; it will...have to pay the usual tolls of delay at each turnpike... and the relief will arrive so late, if at all, as to be little short of ineffectual[5].

The official request to the Surveyor General passed through the proper channels with all speed, though Metcalfe's direct appeal to the Governor was speedier still, and the instrument reached Hyderābād early in June [261][6]. Everest only intended it for secondary triangles, but on his departure for England it was the only instrument available for Olliver's branch series to Calcutta, and proved by no means worthy for such an important task [261].

A valuable astronomical instrument, a zenith micrometer by Dollond, reached Calcutta on Lambton's order during 1823, was purchased from his estate by the Surveyor General, and became one of the most useful of the instruments maintained at the Surveyor General's small observatory [187–8]. Its bill of lading read as under ;

To Colonel Lambton London, 59 St. Paul's Church Yard. 24th March 1823.

Bot. of G. Dollond, Optician to His Majesty, His Royal Highness the Duke of Gloucester[7], and Mathematical Instrument Maker to the Hon'ble Board of Customs, etc.

A Zenith Micrometer, made to order, and upon the principle recommended by Capt. Kater, with the plumb line in the centre of motion, the telescope of six feet focal length with an aperture of 3 & ¾ inches. A strong smeatonian[8] stand, 10 feet in height, and every requisite adjustment, with duplicate sets of screws and eye-tubes, one bobbin of fine wire for the micrometer, and several for the plumb line. The whole packed in a strong deal box, with two

[1] *Meridional Arc* (cix). [2] John Munro [II, 196 n.4]. [3] from Riddell, 15–10–17 ; DDn. 151 64). [4] DDn. 91 (271), 2–4–23. [5] to Charles Metcalfe [12 n.10, 117 n.7] 16-4-23, DDn. 172 (30). [6] Official correspondence hardly fares quicker in the 20th century ! ! ! [7] Wm. Frederick, Duke of Gloucester & Edinburgh (1778–1834); bro. to Geo. III. [8] John Smeaton (1724–92); FRS. ; Civ. Engr. ; designed 3rd Eddystone lighthouse : *DNB*.

locks, handles, etc. an observing plane, etc. Pond's Catalogue of 400 stars [184]. 2 Packing Cases. ... £280. Directed to the care of Messrs. Davidson, Robertson & Co., Calcutta[1].

Though its purchase was sanctioned "for the use of the Trigonometrical Survey", we do not find that it was offered to Everest, who might have been glad of it[2].

One of the few recoveries made from the sale of Lambton's property was "a valuable Astronomical clock by Earnshaw" [254], which Everest found

considerably out of order, and in consequence of the warping of the mahogany frame, it has become of late entirely useless. I put it up this season as usual, but it stopped of itself before it had gone for 12 hours, and after repeated trials I gave the case up as altogether hopeless[3].

He went on to ask that all the more important instruments,

the large theodolite, the zenith sector, the astronomical clock, the two chains, and the brass standard scale, be sent to England in order to undergo a thorough repair and comparison under the hands of the Artists employed by the Hon'ble Company. ...

These instruments have now been upwards of 26 years out of the maker's hands ; ... they have passed through a variety of climates, and been exposed to great vicissitudes of season and changes of temperature, and when it is further considered how very minute the quantity is, which is the object of these splendid operations to detect, I humbly hope that my recommendation will appear to be warranted[4].

Government did not agree that they should be sent out of the country [250, 258], for that would prevent all progress on the survey until their return ;

On the other hand, by continuing the survey with the present...instruments, its progress will be unimpeded, and the services of the establishment not lost to the State, while, by forwarding an indent on the Hon'ble Court, ... we shall in due time receive, not only a complete set of instruments, ... but derive all the advantages to be expected from the numerous improvements which are daily taking place in their construction.

As...the astronomical clock is entirely useless, it may be brought to Calcutta to be repaired or sent home, ... but, with this exception, ... you will direct Captain Everest, ... to deposit the instruments under the custody of the principal staff officer at Sagor[5] [246, 250].

Two barometers which came out on Lambton's order were purchased by Everest on Government account, and he charged a further Rs. 100 for their dispatch "by khossid, ... to avoid as much as possible any accident that these valuable articles might meet with on the road". He also reported that

both of the chronometers...received some injury last year in the mountains, notwithstanding ...the precaution of always carrying them in my own palanqueen. I sent them both to Madras to be repaired by Messrs. George Gordon & Co. [258 n.2], but they were delayed between Nagpoor and Hoosangabad on their return, and did not reach me until long after I had commenced my zenith distances. In this exigency I applied to all my acquaintances within 100 miles...and...met with one by Barrow, which a friend...let me have for 350 Sicca Rupees. I have never made any charge on this account, but now that I am...quitting the department, I hope I may...transfer the chronometer...to Government at the price I paid for it. ...

The Great Trigonometrical Survey is very ill supplied with chronometers, there being but two, one of which (an old-fashioned piece of mechanism by Hare) is absolutely worthless, and the other a small pocket watch by Arnold by no means superior of its kind[6].

An account of the new instruments which Everest brought out from England in 1830 will be given in a later volume [9, 242].

[1] Lambton's Bankers & Agents. [2] BMC. 4–12–23 ; DDn. 197 (114–5). [3] Another clock, by Barraud, bought at Lambton's sale by De Penning, was keeping excellent time in Old Court Ho. St., Calcutta, 1937 [II, 394]. [4] DDn. 171 (322), 2–3–25. [5] DDn. 201 (53), 5–4–25. [6] DDn. 171 (403), 9–9–25.

Surantal
Pardho
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Bhaorasa
Kurwai
Khamkhera
Budhon
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Tikaria
24
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Teonda
SAUGOR
Saugor
Garhākota
Damoh
Sateria
Salaia
Gargaja
Ratgarh
Himilia
Tins
Mandra
Rehli
Emadpur
Bhelsa
Narmao
Bhaugara
Singorgarh
Lakoli
Kalumar
Gidgarh
Anden
Deori
BHOPAL
Ladi
Samasgarh
23°
Bari
Ranipur
Bhimbet
HUSUNGABAD
Subapur
Tek
Morpani
Narwargarh
Shapur
Dhaba Deo
Alampur
22°
Badnur
Betul
Jagdhar
Nilgarh
Atner
Dhar
Salbaldi
Gawilgarh
ELLICHPUR
Takalkhera
Ner
Ashti
77°
78°
79°
E of GREENWICH
21°

GREAT TRIGONOMETRICAL SURVEY, 1823–7
NĀGPUR TERRITORIES

Detail in black shows work of the Great Trigonometrical Survey 1823–7, with the Great Arc in thick lines, as extended by Everest northwards to Sironj [242–6], and the Calcutta Longitudinal Series as carried eastwards by Olliver [261–4].

The map in brown is reduced from one compiled at Madras in 1814 [II, 276 n.6] and its discordance from the G.T.S. and modern maps illustrates the danger of compiling maps from route surveys and astronomical control alone [226, 278].

It was to check such uncontrolled mapping that the posts of Surveyor General at Bombay and Madras were abolished in 1815, and the Surveyor General of India alone made responsible for one general map [274]. It was later ruled that no survey was to be incorporated in the quarter-inch Atlas of India that was not based on, or truly adjusted to, the Great Trigonometrical Survey [283].

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CHAPTER XVIII

CALCUTTA LONGITUDINAL SERIES & OTHER TASKS

Calcutta Longitudinal Series, 1825–30 — Dr. Voysey, Geologist to G.T.S., 1818–24 — Other Geological Surveys, 1817–28 — Visual Telegraph, 1817–28 — Natural History — Meteorological Observations.

IN his account of the Calcutta Longitudinal Series[1] General Walker suggests that it was taken up against Everest's advice, but this is not so. The whole matter was fully discussed between Everest and Blacker at Calcutta, and they agreed that, all things considered, this was the most suitable and useful employment for the available staff [9, 241–2]. It was not at the time intended that this series should become a major branch of the trigonometrical survey, and there was no series of less importance on which Olliver could have been employed to better effect.

Everest was satisfied that Olliver was fully competent, and left detailed instructions that were scrupulously followed. He knew that the 18-inch "circular instrument" was not suitable for principal triangles, but it was the best available;

I had expressly declared the principal instruments of the Great Trigonometrical Survey to be so shattered by exposure to climate, wear and tear, ... and various accidents, as to render them quite unfit for further employment, so that there only remained...an 18-inch instrument of inferior powers, which Sir Charles Metcalfe, when Resident at Hydrabad, had kindly obtained for me from the Madras Observatory [259–60]. ...

I never approved the employment of this instrument in the principal triangles of any part of the Great Trigonometrical Survey. ... I never had occasion to use it for other than secondary triangles. In a minor series, on one of the subordinate meridians for instance, it would answer exceedingly well with some alterations and, if employed at all in the principal triangles, ... it would be certainly less objectionable in a longitudinal series than in that of the Great Meridional Arc. These are the opinions which I gave at the time to Colonel Blacker[2].

Whilst Everest and Olliver were in Calcutta in 1825, Rossenrode ran a secondary series from Sironj to fix the position of Saugor [246][3]. His chart, with a copy of the observations "both night and day", and full calculations, were sent down to Calcutta on 19th December.

Olliver joined him at Saugor towards the end of the year, and started work in January 1826 from the Great Arc side Bhaorasa–Gargaja [pl. 17] with three assistants in all[4]. Rossenrode was employed selecting stations in advance until he fell sick in May. In the neighbourhood of Hatta the selection of stations was particularly difficult, "the country being one general succession of flats bearing no prominent features", and during the hot weather the atmosphere was so thick that large signal fires had to be lit at each forward station [244].

He went forward again in October with Peyton, each with "a small theodolite and reconnoitring telescope", whilst Olliver went back to his earlier stations to make sure that the mark-stones had not been tampered with [245]. Whilst at Saugor Olliver brought out the large 3-foot theodolite, and found its more powerful telescope greatly superior to the feeble one of the 18-inch instrument [248]. There was still a lot of fever about in November; Rossenrode was again laid up for a month, and Olliver had six cases in his camp, one man dying after 3 days illness.

Visibility was good and with the aid of blue lights [247–8] Olliver brought observations up to Hatta by January 1827, with Rossenrode and Peyton

getting on in their task, which is doubtless difficult, more so from the continuous flats, and...

[1] *GTS.* VI (iii–vii, B). [2] SG. to Govt., 5–2–32 ; DDn. 283 (25). [3] 17th Oct. to 6th Dec. 1825.
[4] Rossenrode. Peyton, and Torrick [327].

their being thick set and covered with old mowah trees[1], such as with difficulty 4 men could fell one tree the whole day. ... The country E. of Belhari bears a very favorable appearance, being a fair open country with detached hills.

Further east the country was "wild, desolate, and unhealthy";

The operations...are now about entering the Rewah State, and...the survey stations in advance...close on...Singrowlah and Sirgoojah states [88]. In penetrating further...where the people are not warned, ... he [Rossenrode] may have to encounter still greater difficulties. ... Until...the Agents for the Governor General at Benares, Arrah, and Hazareebagh have been apprized...I feel loth to allow any party to advance. ...

Accounts from Mr. Rossenrode describe the country in advance...as being thinly inhabited by Goands, a wild and savage people [I, 60; III, 243, 299, 414–5], and as one scene of desolation, provisions scarce, and oil in particular, which is used in no small quantity at the several stations, is not to be had even for a single lamp[2].

In July 1827 the whole party withdrew to Mirzāpur for the rains. Observation had reached meridian 82°[3], and under the Surveyor General's instructions a branch line was run to the ancient Hindu observatory at Benares[4] [I, 156–7]. Next year there was a great deal of sickness and Olliver writes from Gaya telling of

hardships, sickness, and numberless other mortifications unprecedented. ... Myself in bad health, both the younger sub-assistants laid up with the fever and, in fact, the better half of the department was totally useless ; ... besides the death of 6 of the men [405].

In this predicament I was under the necessity of calling in Mr. Rossenrode...who by this time had nearly reached Hazaribagh. On his arrival, I was further mortified on seeing the train of sick that followed him, [and] I was under the painful and urgent necessity...(the native doctor also being one of the dangerously sick) to request him to take charge of the sick, quit the jungles, and proceed to the nearest station where medical aid could be procured. ...

After Mr. Rossenrode proceeded with the dangerously ill...to Gayah, I was able, what with the aid of Mr. Torrick, just recovered, and the convalescents, ... to finish for the season ...in Palamow, ... and quitted it for this station in the beginning of the past month. ...

I was still more unfortunate with respect to the weather, for in March and April, for about 40 days together, the whole extent of view was one continued smoky atmosphere [76, 184], owing to the blazing of the grass and brushwood, and...neither the signal fires, nor even the blue lights, were at all discernable, ... so that all this time I could but finish with only two stations [247]. ... The fires seen in all directions caused a great confusion...various instances occurred in which the flag lascars, mistaking the fires for signals, quitted their stations and actually joined me, while I had continued still looking out for their lights. ...

Enclosed are two medical certificates...on the state of the sick. Mr. Peyton is quick recovering, and has just commenced attending to his duty ; most of the sick have also quite recovered. Mr. Rossenrode has had the misfortune a few days ago to lose his son of the fever[5].

During field season 1828–9 observations reached more open country;

Having experienced extremely hazy and oppressive weather, I was compelled to remain on the Parasnat mountain[6] station from the middle of...March to the beginning of May, and though recourse was had to the use of white lights—... one night forty double white lights were burnt, of which I was only able to discern two—and, though a pile of wood of about 6 feet diameter at the base, and tapering to a height of about 12 feet, was blazed as a signal, ... even this immense blaze was not discerned...where...one of the assistants had been...stationed with a theodolite to watch my signals. ...

After repeated disappointments from a continued watching of no less than fifty consecutive nights, and...the increasing rage of fevers, etc., and the then appearance of the epidemic cholera, I resolved on quitting...to the next station of observation ; but I had scarcely been half way when a most favourable change of weather occurred, so that after having finished at the station I availed myself of the good weather to revisit Parasnat, ... and...I finished on the first evening all the elevations and depressions of the stations, and...on the same night in three hours all the observations which before detained me for no less than fifty nights together[7].

The triangles were now approaching the plains of Bengal, "one continued undulate country, interspersed with lofty groves, of chiefly mango trees which form a very formidable impediment." Olliver proposed masonry towers, as a portable scaffold would be difficult to centre over the mark, and

[1] *Bassia latifolia ;* a valuable tree, growing to 50 feet, both food and liquor being produced from the flowers. [2] DDn. 174 (100–2), 5–4–27. [3] Skeleton map of triangles, Sironj to long. 82°, *Ben Regr.* 588 (32). [4] Positions of secondary stations, Benares Series, *Great Arc Tables* (61–2), 1842. [5] DDn. 173 (97–102), 1–8–28. [6] 73 I/1 ; ht. 4480 ft. [7] DDn. 173 (133–6), 15–7–29.

it would be indeed very imprudent to risk the instrument or the lives of those in attendance at the observatory on it, at night or even in the day, during the high windy months in particular, unless a very expensive and bulky sort of machinery be constructed.

In the case of scaffolding also, while engaged in night observations, it would require the utmost caution, and even then it would be extremely imprudent to allow the instrument to remain at night on the scaffolding, and...to have lights...blazing, ... so that...when the scaffolding is adopted...only day observations must be used. ... In this case, as it will be impossible to have the stations at greater distances than 25 miles asunder even in good weather...(in the months of March and April it would be difficult to discern the signals at the distance of 15 miles), ... it will require many more station to cover the same...country[1].

The problem had been foreseen by Blacker in 1823 [185] ;

Many extensive tracts are so flat as to defeat the principles and instruments of the Great Trigonometrical Survey, unless at the monstrous expense of erecting numerous artificial points to supply the place of natural elevation. It would be idle to enter into any calculation of the number which in that case would be required. for their height and stability would involve so great a disbursement...that...would many times exceed any expense which could...be recommended[2].

The extension of triangles across the last hundred miles to Calcutta was therefore a matter for careful reconnaissance, for Olliver was determined not to depart from Everest's regard for well-shaped triangles ; no angle greater than 90° or less than 30° Rossenrode and his reconnaissance party had to abandon

the tract...S.E. of Bancoorah[3], ... an extensive flat, covered by an almost impenetrable forest of stately trees. They persevered for several days in that wild tract, infested with tigers, by ...raising one ladder above another lashed to the tree, until they could get to the branches, whereby they were able to climb upwards of 60 feet, and after repeated disappointments they were induced to abandon it with the conviction that it would require to build no less than 80 feet. ... The dread of tigers was such that the Bengalese labourers, who had to attend the party with cutting implements, ... would at every rustle of the dry leaves throw down the ladders, and...disperse in all directions.

Mr. Rossenrode and Mr. Peyton are now engaged in exploring the tracts bordering on the road between Bancoorah and Burdwan for the southern stations, and north of the Damooda river for the northern stations. This tract may be considered an open country, but...the difficulties to be overcome is still very great owing to the close-set villages, and the lofty trees of mango, banian, etc., which surround them present a formidable obstruction in all directions, and which ultimately is to be overcome only by being able to build equally as high as the trees.

Rossenrode wanted a station at Bhalki[4], but, writes Olliver,

though he constructed a rude stage of 18 feet high over a tank bank 7 feet high, he was unable to overtop the trees about the village, so that...it will require to build about 40 feet high or more, or to lop away the branches of the trees, which would in all likelihood annoy the villagers. ... Mr. Peyton...describes the country to be altogether alarming, ... adding it as his firm opinion of the necessity of resorting to the telegraphs. ...

I have been obliged to detach the 3rd sub-assistant, Mr. Murray Torrick, to select the intermediate stations ; he will have to explore another very jungly tract, but the land is high, withal ; he will have to clear more than one eminence before he can be satisfied in his selection[5].

The very next day Olliver had " a very cheering letter " from Rossenrode who

was able to discern the signal fires blazed at the stations of Radamadapoor and Dhunsimlah[6] from the tank bank of Balkee...but...[these] stations are on high lands, and the stations for which Mr. R. next proceeds...will be in the flat country. ... Mr. R. assures me that Mr. Peyton's appalling description is not to dishearten him, and I am confident that he will strenuously persevere to attain his object ; he will leave nothing unsifted in any shape that could be devised and, if his absence from the scene of operations happens to be at all protracted, ... I shall be utterly at a stand until his return. He is the main prop, for...the work of station selecting is the most irksome and the most delicate part of trigonometrical operations[7].

Herbert had suggested making use of the telegraph towers that had been recently abandoned. They were laid out in a single line [271–2], and might serve as stations along the right flank if Olliver swung his series towards them. Olliver agreed, but asked for alterations to their superstructure and pointed out that Everest would certainly expect the instrument to be on a pillar isolated from the main walls.

[1] Berhampore, 15–7–29 ; DDn. 173 (133–6). [2] DDn. 204 (9), from SG., Blacker, 26–12–23. [3] Bānkura, 79 M/4. [4] 73 M/11, 25 m. NW. of Burdwān. [5] DDn. 173 (148–51), 8–2–30. [6] on G.T. Road m. 113½ ; on the railway, 29 m. from Bānkura. [7] DDn. 173 (153–4), 9–2–30.

He asked that the Executive Engineer should make out suitable designs, for he himself was "in no-wise versed" in such matters.

Work pushed steadily forward—Rossenrode was now less than 70 miles from Calcutta—special mounds and towers were erected at some places—telegraph towers adapted at others. Olliver reports in August 1830 from Burdwān, where the party sheltered for the rains ;

Having experienced much unsteadiness in the Mahdpoor scaffolding, though the posts were of whole palmyra trunks[1], the braces and stanchions were also of palmyra, I am...of opinion that for the permanent stations scaffoldings are better dispensed with [263]. Besides the immense labour and pains requisite for the proper...erecting of them, and the uncertainty of their holding out, ... it is by no means...either cheaper or expeditious. ...

I made a trip to Bhalkee where, finding the old position of the station to be on a narrow tank bank, too slight for building on, I ventured to alter the position to more firm ground. The work of building...will be finished during the continuance of the rains. I shall...have to...inspect the work...though the only mode of moving about the country now is to wade, chiefly through ...inundated paddy grounds, and...with elephant or palankeen at a creeping pace. ...

Messrs. Rossenrode and Peyton have established two other positions as stations, but owing to the formidable topes it was not possible to ascertain positively what heights the buildings ...should...be. ... From...their having contrived, by means of bamboo scaffoldings, to use their theodolites at an elevation of seventy-six feet above ground, and at that height still unable to overtop obstructions, ... the buildings at both these places will require to be at least fifty-five feet high, whilst the rest will have to depend on the lopping off of the most conspicuous trees. ...

With respect to the enormous expence...of the Mahdpoor scaffolding, ... it being a new sort of a machinery to the country artificers, it was all to do to keep them to work and, the posts being entire palmyra trunks, it was no easy matter for the artificers to cling to them, and even to have the free use of one hand, before the machinery was...perfectly safe, and which required several days with repeated doing and undoing...before it could be properly adjusted[2].

Most of the 15 tower stations were built after Everest's return in October 1830. Four of these were adapted from the telegraph towers, one at Nibria, 5 miles west of Howrah being still in good condition in 1950, 88 feet high [272 n.9]. All field work was completed before the rains of 1832.

Olliver's work came in for much criticism later, and the standard of accuracy was not, indeed, nearly high enough for such an important link in the great frame of triangulation. But blame should not be attributed to Olliver, who was working with a most inadequate instrument, and strictly to instructions. So many as sixteen of the later meridional chains of triangles were dependent on this longitudinal series, which was nearly 700 miles long, and it was eventually found imperative to have it entirely re-observed. This did not take place until 1863, and again occupied six years. Olliver's work, writes Waugh,

was executed many years ago with an inefficient 18-inch altitude and azimuth instrument by Cary, of an old pattern [259–60]. ... The system of observation...was bad. The face of the instrument was never reversed [251], consequently the angles are all, more or less, affected by error of collimation and inclination of axis. ... These errors...appear to have been very large, no attempt having been made to eliminate them, ... nor to render their effects nugatory by a proper system of observation. ... No process, short of a thorough revision of the field work, can prove perfectly satisfactory. ...

The Calcutta Longitudinal Series is 671 miles long, and...the linear discrepancy at the Calcutta Base[3] is 5.255 feet in 6.431 miles. ...

Observations for azimuth were taken...at nearly every alternate station on the north flank, or about every degree of longitude apart. The errors...of instrumental adjustment vitiated these...excessively, and as the latitudes...were computed by means of these elements, the magnitude of the azimuthal errors is in fact the most important defect in the work[4].

DR. VOYSEY, GEOLOGIST TO G.T.S., 1818–24

On the appointment of a geologist to the Great Trigonometrical Survey [225] it was particularly stated that his reports on the geology of the country should

[1] *Borassus flabelliformis*, palmyra palm. [2] DDn. 174 (219), 4–8–30. [3] measured by Everest in 1832.
[4] DDn. 671 (17), June 1853, cf. *GTS.* II (71) & VI, B iii.

keep pace with the work of the surveyor, that attention might be drawn to anything that might influence geometrical and astronomical observations [254]. In his reply to a question as to "how far the operations of your survey are likely to benefit from the geological observations"[1], Lambton reported that he was sending Voysey to accompany Everest's first serious independent survey [229] and was

particularly anxious that he should succeed in his geological pursuits. The near alliance of that branch of science with our geographical operations is well known to the learned world; and the mutual benefits that must accrue to each other from their advancing hand in hand will, I trust, appear from the results of our combined labours[2]

Everest's account of this expedition refers frequently to geological details and their probable influence both on triangulation and health[3]. Voysey's professional report was submitted to Fort William and a box of specimens sent by sea from Masulipatam[4]. A year later Lambton submitted a further report from Voysey, explaining "what he had already done, and what his ideas are respecting that part of the Peninsula through which my meridional operations have been carried"[5]. In this report Voysey writes that

since my last report, ... dated June 24th 1820, accompanied by a geological map, drawings, etc., and followed by a box of specimens, collected and arranged with considerable care, I have made ...an addition to my geological map of about six degrees of latitude and longitude. ... I have completed three barometrical and geological sections, one of which is nearly five hundred miles in length, and...I have sufficient evidence to decide on the rock which is the matrix of the diamond, hitherto a desideratum in mineralogy. ...

A very important object...lies in determining the cause of those anomalies which sometimes occur in trigonometrical operations, and which can only be explained by supposing them to arise from concealed disturbing forces, owing to the difference in the specific gravity of the upper, lower, or contiguous strata [II, 261; III, 254]. The error in latitude at Arbury Hill in the Trigonometrical Survey of England, supposed first of all to have arisen from the imperfection of observations or of instruments, has since been attributed with great probability to the above-mentioned cause. The fact is only to be ascertained by a person accustomed to observe the manner in which strata of different densities dip, their direction and relation to one another. To this object my enquiries and observations have been particularly directed[6].

In 1822 Lambton sent him to explore the country between Agra and Berār through which the meridional arc was to be carried [236];

The season being now favourable for going round to Calcutta by water, and thence up the Ganges, I have permitted Mr. Voysey to go by that route; ... he will have full time to meet me at Nagpoor before I proceed north from Ellichpoor. ... I shall...make such arrangements that our mutual labours may be more immediately combined, by applying certain scientific investigations of mine to geological purposes. The field for geological science in India is now become extensive and interesting, and a man of Mr. Voysey's...talents...must render his services a benefit to his country and an honour to himself.

At the same time he urged that Voysey was worthy of more generous terms, and recommended, without success, that he should be appointed an assistant surveyor, reporting several occasions when he had helped in actual survey[7].

Voysey returned from his expedition in June 1823, after Lambton's death, and submitted to Everest a most useful report on the line from Ellichpur to Agra [243–4]. He also brought back geological information that enabled him to extend his section, Madras to Ellichpur, northwards through Sironj to Agra, making it about 1,000 miles in all. He had now been absent so long from regimental duty that he found himself put on half pay, and Everest pressed again for his appointment as assistant on the survey,

having afforded great assistance in taking observations on different occasions. ... As the country through which I am about to proceed is one of no ordinary danger and difficulty, ... Mr. Voysey, I know, will never refuse me his assistance when called on, and I will put it to your consideration whether Government can fairly benefit by Mr. Voysey's services without giving him a salary for the same[8].

Government was however adamant in its refusal, and Voysey sent in his resignation, with a summary of his services;

[1] DDn. 64 (73), 8–5–18. [2] DDn. 92 (90), 1–6–19. [3] Geo. Everest (12–3, 19). [4] Lambton to Pub. Dept., 11–7–20; DDn. 92 (136); report pubd. *JASB*. II, June 1833 (298–305; 392 *et seq*). [5] DDn. 92 (187), 9–6–21. [6] ib. (188–90), 8–6–21. [7] ib. (231–3), 19–6–22. [8] DDn. 91 (359–61), 3–10–23.

I have completed two principal barometrical and geological sections, one extending from Bombay to the mouth of the Godavery, and one from Agra to Madras. In addition I have completed several minor sections of 3, 4, and 500 miles each, and a geological section of the country between Calcutta and Agra. I have consequently the materials for making the only geological map of India that has yet been attempted.

It is now five years since I joined the Trigonometrical Survey...and during that period I have been constantly in my duty, notwithstanding I have been twice subjected to fever caught in the jungles on the banks of the Godavéry. I have travelled by land about eight thousand miles, and have always been in camps, with the exception of few months. ... All my instruments and books have been purchased at my own expence. ...

I...trust that in consideration of my travelling down the new road from Nagpoor to Calcutta[1], and producing a geological and barometrical section of that unexplored country, I may be allowed to draw my present salary of 600 rupees per mensem until I reach Calcutta, which I engage to do before the middle of March next[2].

With Everest's permission he set out from Tākarkhera on 6th January, but he never reached Calcutta; he was struck by fever, and died on the 19th April, two marches short of his destination. From the tragic circumstances of his death it was a long time before his later professional reports were properly edited and published, most of them being collected in the archives of the Asiatic Society of Bengal. Those of 1819 and 1821 [265] appeared in 1833 or earlier, but it was not till 1841 that his notebooks were properly examined, and an account of his later professional work prepared for publication[3]. The geological map of 1821 had been sent to London, and was sent out to the Society 1844[4]. Voysey had never been able to prepare the extended map which he had planned.

Markham records that he was

one of the earliest writers on the rocks of the Deccan. He explored the Nalla-Malla mountains between Cummum in Cuddapah and Amrabad north of the Kistnah, and wrote an interesting account of the diamond mines in southern India[5]. He also wrote papers on the building stones of Agra, and on petrified shells in the Taptee valley.

OTHER GEOLOGICAL SURVEYS, 1817–28

A few months after his move to Calcutta, and after the announcement of Voysey's appointment to Lambton's survey, Mackenzie writes to Riddell;

Geology is the great fashion here now. Three or four eminent geologists & naturalists have arrived in the course of these 18 months; one very lately from France [De Vaucel], who is the precursor of the celebrated Humboldt [44 n.5] who is expected out next year.

My collection of minerals and stones proved more valuable than I even supposed myself. There are two chests of them, & I have had a Dr. Voysey attending here for some time arranging and classing them, & selecting specimens for 3 or 4 other collectors[6].

From early days there had been legends about the mineral wealth of the Himālaya mountains, and in 1817 a special geologist was attached to Webb's survey in Kumaun. Lord Moira, Governor General, took special interest;

Mr. Laidlaw has come out...by permission of the Court of Directors, specially...to seek employment as a mineralogist, or as an investigator of any other branch of natural history. ...

The Court must have naturally trusted that we should not fail to employ him if any return commensurate to the expense should present itself. ... The probability of great advantage from researches...by a person so qualified as Mr. Laidlaw is clear enough. ...

We have been duly sensible of the want of professional enquiry into the mineral produce of the hill country lately acquired by us. The remedy now offers itself. I therefore propose that Mr. Laidlaw be engaged for a fixed term at a monthly salary of 600 rupees, exclusive of his travelling expences[7], ... and that he be attached to Lieutenant Webb for the purpose of seeking indications of metallic veins in the tracts which that officer is surveying.

To copper or iron I would not point Mr. Laidlaw's attention, as I think the working either might injuriously effect important articles of British export[8].

[1] Surveyed by J. N. Jackson [27–8]. [2] DDn. 171 (134–5), 1–1–24; cf. *GTS*. I (xxxiv). [3] *JASB*. X, 1841 (415); XI, 1842 (864, 892); XIII, 1844 (xlix, 853–62). [4] CD to India (Pub), 1–11–43; CD to ASB, 27–1–44; it could not be found for the centenary exhibition of the Geol. Svy. of Jan. 1851. Markham (207). [5] *As R*. XV. 1825 (120 *et seq*). [6] DDn. 156 (327), 13–2–18. [7] Same salary as Voysey [*sup*., 268]. [8] The bad old days! DDn. 133 (199–201), 6–6–17.

In accepting the appointment Laidlaw asked for suitable chemicals and apparatus for mineral analysis, besides a few simple survey instruments ;

I am far from saying that everything I have mentioned is absolutely indispensable ; on the contrary, ... I might even be correct in my investigations without any apparatus at all ; but it is surely better to be provided with the means of enforcing such success than to have it dependent on the chance of favorable circumstances[1].

He joined Webb during February 1818 and almost at once went off on his independent researches, and for the next two years not only made no effort to co-operate with Webb, but persistently failed to report his proceedings. After twelve months he was warned that if he did not furnish

a satisfactory explanation of the delay by return of post, orders would be issued for the stoppage of his allowances. A period of two months having elapsed...without communication, ... orders were transmitted on the 13th May 1819 to the Commissioner in Kumaon for discontinuing the payment of Mr. Laidlaw's allowances, of which Mr. Laidlaw was duly informed[2].

No reply was received, except for a refusal to hand in his instruments to Webb. He was dismissed and the Directors considered his conduct

so highly objectionable and improper that we...direct that that gentleman be not again employed in any public capacity under your Government, nor allowed to remain longer in India than may be necessary for him to prepare for his voyage home. The period for which he had our permission to reside in India being already expired[3].

Laidlaw ignored these orders, and continued to live in Kumaun where he died in 1836 [367]. No information has been found about his work even in Herbert's reports [268–9], and it is not known how Markham learned that " he was a very able man, and is said to have been badly treated "[4].

Towards the end of 1819, Sir John Malcolm, who was in political charge of Mālwa where he had employed a number of officers on survey and mapping, recommended that Frederick Dangerfield should be put on special duty to make a general survey of the resources of that country [123] ;

Iron ore of good quality, and...copper, abounds in these tracts. ... The survey of Malwa... should be combined with a complete statistical and scientific account, embracing its peoples, manners, customs, and village rights ; its vegetable productions, manufactures, mineralogy, geology, and natural history in every point. ... Captain Dangerfield...proceeds in the end of December upon a survey of the opium produce of Malwa, ... which should include the filling up the blanks left in our geographical labours, the completion of our statistical papers, and an account, as minute as could be made, of the mineral and vegetable productions. ...

If my suggestions be adopted, I will so launch this survey that it shall at an early period make a return more than adequate to the expenditure[5].

Dangerfield took the work up with enthusiasm, but early in 1821 was sent down to Bombay to recover his health. With his own map of Mālwa Malcolm sent in a geological sketch from Captain Dangerfield[6]. ... His health, which had been much broken by his unremitted exertions during the last three years, compels him to proceed to the sea coast, but he will on his journey to Bombay, and after his arrival at that place, continue to complete the index of towns and villages of Malwa, and...arrange for transmission to Calcutta, if desired, the great variety of geological specimens which he has collected. ... The completion of this task cannot be expected before the end of May or April [84, 123]. ...

To complete the geological investigation of...this part of the peninsula—...with correct astronomical observations of latitudes and longitudes—... with remarks on the different levels of the country, as well as the larger features of its geography—I know of no person more qualified than Captain Dangerfield. ... The accurate investigation of the teak forests in the valley of the Nerbuddah...I deem an object of some consequence [II, 168][7].

Dangerfield was, however, granted nine months leave on medical certificate, and sent on a sea voyage, being allowed to accompany Crawfurd's mission to Siam and Cochin China. The Surveyor General meanwhile strongly recommended that on his return he should take up the geological survey that had been entrusted, without result, to Laidlaw ;

[1] DDn. 141 (309), 3–7–17. [2] DDn. 145 (347), 11–8–20. [3] CD to B., Mil., 29–10–23 (17) ; DDn. 205 (48) ; BPC. 14–9–36 (18). [4] Markham (207 n.1). [5] DDn. 145 (1), 25–11–19. [6] Danger-field's report pub. 1823 in Malcolm's *Central India*, II (320) ; Markham (208). [7] DDn. 191 (101–8), 10–2–21.

Captain Dangerfield's wish is, when he shall return from the expedition to the eastern islands, ... to make mineralogical and geological enquiries and surveys in the mountains and to collect facts...respecting the structure of the mountains and the earth. ... The enquiries have not indeed been neglected ; ... Mr. Laidlaw was sent to the Kumaoon mountains to make such, but how he has fulfilled what was expected from him I do not know.

On the Gurhwall survey also [35–8], Lieutenant Herbert and myself directed some notice to the subject, but since I left the mountains, that officer has made a very extensive and valuable collection of the minerals, fossils, and specimens of the various rocks composing the different chain of mountains, and he has also attained to a very respectable knowledge of the theories of geology, or geognosy, from books. ... Indeed, ... I have hopes that the information he can afford...will be valuable, and probably more so than that of Mr. Laidlaw who, though sent to this country as a person of skill in that particular line, does not appear to have had the advantage of liberal education, and, though in some points he may be able to describe the minerals more accurately than Lieutenant Herbert, the latter must have greatly the advantage in taking a general view of the subject, and in describing the specimens, and, what is of great consequence, being able to shew clearly and in good language the heights, the positions, and every particular of the ranges of mountains from which he selected them[1].

Dangerfield's appointment was sanctioned, his allowances being fixed at "rupees 1,000 per month, in addition to the pay and full regimental allowances of his rank", considerably more generous than Voysey's Rs 600 [266, 326]. As it turned out, however, he preferred the opium department in Mālwa[2], and in February 1823 Herbert was appointed "to conduct the Geological Survey of the Himālaya Mountains"[3]. In July of the same year James Manson was appointed his assistant[4], and stayed till the survey was closed in 1828.

Herbert started work in January 1824, and submitted his first, and incomplete, report with a geological map[5] 30th November 1826 ;

Mineralogical Survey of the Himalaya Mountains lying between the rivers Sutlej and Kalee; Illustrated by a Geological Map ; by Capt. J. D. Herbert, Superintendent. With 12 large coloured views of mountain scenery and descriptions by Captain J. Manson, Assistant[6].

Geology as a science [writes Herbert] has not yet attracted in India that attention which its importance merits, and it would be futile in me to deny that till selected for this duty I had but a slender acquaintance with the subject. While exploring...this tract, I have been in reality studying the principles of that science, an advantage in-as-much-as I may hope to have escaped the trammels of system.

Though in some directions the survey had proved disappointing,

in the Copper, Lead, and Iron, however, in which the province abounds, may be found a more tangible, as well as more productive, source of wealth. It is certain that the former metal exists in very considerable quantity, and for the iron nothing is wanting but a proper system of management to render it superior to that of England. Graphite, a substance of considerable value, has been discovered[7].

The report and map were produced as a special supplement No. 126 with the *Journal of the Asiatic Society of Bengal 1842*[8], which also contains an account of Herbert's last tour through Kumaun between November 1827 and January 1828[9]. In June 1828 he started back to Calcutta to resume duty in the Surveyor General's office [310].

This mineralogical report had been the concluding part of Herbert's rough draft, the rest of which he had never written up, being interrupted by ill-health and his transfer to Calcutta and then to Lucknow where he died. His geological specimens lay in the museum of the Asiatic Society until the Curator opened them up some years later, but found " not a line of catalogue, journal, or note ". After much correspondence, five volumes of notes and journals were discovered at Almora. Two were neat and legible and, writes Batten from Almora[10], described a tour

[1] SG. to Govt., 27–9–21 ; DDn. 96 (105). [2] He married at Penang in May 1823. [3] BGC., 27–2–23 ; DDn. 203 (5). [4] Herbert had m. Manson's sister in April 1823. [5] Map dated 1826, 16 m. to inch; copied SGO. Feb. 1827 ; from Sutlej to Kali, based on svys. 1816–22 [pls. 5, 6]; pubd. *JASB.* XIII, 1844 (appx. 171). [6] Original Report at NAI. ; Home Dept. Misc. vol. 437 A ; *As R.* XVIII, part I (227 *et seq* ; *JASB.* XI, 1842, part 126 (i–clxiii). [7] Copper and iron not workable in Kumaun ; Burrard & Hayden (354–356). [8] but not noted by Burrard & Hayden. *JASB.* XI, 1842 ; XIII. 1844 (171, 734). [9] Copy of Report to Directors under B to CD. 1–2–27 ; BM. Addl. MS. 14381, comprises 169 pp. [10] John Hallett Batten (1811–86), BCS. asst. Comnr., Kumaun, *c.* 1835–45.

to the lower ranges of Sirmoor and the low country and hills about...Roopur, below the Soobathoo mountains, to the Terai east of the Jumna belonging to the Saharunpore Zillah, to the Dehra Doon, and then crossing the Ganges along the edge of the Bijnore and Moradabad and Pilibheet Terai, to that of Kumaon, ... and thence to Almorah.

Capt. Herbert stayed at Almorah a whole summer and recorded observations. Thence his journal shows his tour...towards the Juwakee Pass...and the snowy range. ... Before reaching Melum Herbert fell ill, and his journal ends. ...

Three other volumes of ms....are all badly written, and parts of them very obscure. ... Nobody at Calcutta can possibly interpret the volume. ... I therefore propose to edit it myself. ... James Prinsep gave up the task in despair. This volume also contains Captain Manson's continuation...to Melum, and back over the hills to Almorah. In its present state I defy anyone who has not been at every place named to decypher the words and fill up the gaps caused by moths and white ants[1].

Batten then describes Herbert's final tour to Dehra—through the Dūn—across the Jumna to Kālsi—into the hills through Jaunsar and Jubbal to the Borendro Pass—down the Pabar River to the Tons—and back to Dehra over the Mussoorie range. From here he closed work and started his journey down to Calcutta. "I do not think" writes Batten "that anything very novel will be brought to light by the journal". Of another rough journal the museum Curator writes;

From a cursory examination...I congratulate the Society very sincerely upon the amount of geological and mineralogical knowledge; ... if we can but connect Captain Herbert's complicated system of numbers[2].

Amongst other reports about minerals is one from Grant, in Moulmein; [199];

I received some specimens of lead-ore brought from near Youn-Zolune. It is found in the bed of the creek which, having its source near that town, falls into the Salween about 10′ or 15′ above Miang[3]. The mineral is said to be very abundant, and yield from 30 to 40 per cent. These ores were not worked by the Burmese Government, and it was certain death even to be found in the act of seeing it. It is not therefore an easy matter to procure specimens of minerals from opposite banks. The dread inspired by former tyranny still paralyses the natural bias of industry. To the same cause we may ascribe the ignorance of the people regarding the mineral riches of the district. ...

The ore has been worked by Oojna (a chief in rebellion) for some time past, but I suspect it is not for the sake of the lead alone. The carriers [Karens ?] are the proper people from whom to obtain ores, but they are said to be a very unaccomodating people.

In March the carriers [?] come down with the productions of their country, consisting chiefly of wax, honey, ivory, oil of sessamum, etc., and receive in exchange the manufactures of England, India, and China[4].

It was not until 1851 that the regular department of Geological Survey was founded under Thomas Oldham.

VISUAL TELEGRAPH 1817–28[5]

The normal means of postal communication in India was by postrunners, clad in a loin-cloth, carrying a light bundle of letters fastened with a few jingling bells to a short spear sloped over the shoulders. Such men run to this very day, sometimes singly, but in jungle country more often in pairs. *Dāk* was laid in regular stages, each stage having its regular runners passing to and fro at a steady jog-trot. Stages were about eight miles each, and post travelled up to seventy miles a day [I, 303]. The "Bhangy Dawk", or parcels post, the runner's springy staff bearing a load at each end, was a less speedy business.

In 1813 William Boyce, of Bombay[6], put forward a scheme for establishing lines of telegraph signals from one end of India to another. Such lines had been successful in Europe for the rapid despatch of messages over long distances. In recommending these proposals, the Bombay Government remarked that

[1] from Batten, 8–2–42; *JASB*. XI, 1842 (583–4). [2] from Curator, 31–5–42 ib. (603); Herbert's Journals, ed. by Batten; *JASB*. XIII, 1844 (734 *et seq*). [3] Yunzalin, joins Salween, 94 G/11. [4] DDn., 221 (229), Grant's Report on Tenasserim; 1827. [5] *IHRC. Progs.* XXVII, 1950 (78–85). [6] Wm. Boyce arrd. as "free mariner" before 1805, when he first proposed the telegraph; "keeper of the Bombay Tavern", 1813; m., Bombay, 4–3–07, Mrs. Mary Ann Savage, widow; partner of firm Boyce, Kemp & Co. 1819 (?).

a man better qualified than Mr. Boyce to superintend the establishment could hardly be found. He was for some years employed under a very enlightened man, Mr. Edgeworth[1], in the management of the telegraphs in Ireland.

Boyce himself records that

the first modern telegraph that...attracted any notice was the one...submitted to the Committee of Public Safety in Paris in 1793 by Monsieur Chappe[2], and is...in general use throughout the French dominions. The next is that...invented by Lord George Murray[3] about the same time and is...established along the coasts of England.

He had himself been employed as land surveyor under Edgeworth on the erection of telegraphs round the coast of Ireland after 1803. He described the immense advantage that Chappe's system gave to Napoleon. His own system was to be an improvement on that used by Edgeworth, worked by the display of large triangular vanes in seven different combinations;

The machinery is so simple as to be perfectly manageable to a boy of ten years old. ... Mr. Edgeworth's system worked with stations twenty miles apart. A message requiring 6 hours of time by Lord George Murray's telegraph could be managed with Mr. Edgeworth's in 33 minutes. ... I have effected improvements...which render it infinitely superior to any telegraph whatever. ... When an overland dispatch arrived or any news of importance by sea, it could be communicated to the Supreme Government in half an hour, and an answer received back in the next half hour[4].

The Supreme Government was interested, but asked for reports on the lines to be traversed and the number of stations required; they pointed out the danger from plunderers such as *pindāris* to whose attacks the posts would be particularly vulnerable. The Surveyor General was consulted. Boyce had proposed two routes; the first from Bombay via Poona–Hyderābād–Ellore–Cuttack to Calcutta, 75 stations; the second, from Bombay along the west coast to Mangalore, and then via Seringapatam and Bangalore to Madras, 133 stations. Mackenzie was critical;

Whilst I have the highest opinion of the great superiority of Mr. Boyce's telegraph over any other...of the same kind, and also duly acknowledge the numberless advantages that would accrue from his plans, ... yet I cannot help differing...when he proposes to commence the towers without having the whole extent of the country examined by a skilful engineer. ... I do not think with him that the building of wooden houses...would answer, as they would be so liable to such rapid decay, not only from the...climate, but also from...the white ants.

With respect of the number of towers required, I do not think it could ever be even guessed at, for, as the telegraphic part of the tower is only about 16 or 17 feet high, when a jungle tract was to be got through, they could not see each other at a furlong's distance. ...

Mr. Boyce...has...overlooked some obstacles that, had he travelled much in the peninsula, he would have found very difficult to overcome. ... First...the Pindaries, or any other lawless tribes; for, although the towers may be musquet proof, and sufficiently strong to prevent the tower being carried by force, yet how are they to procure water or provisions? If the tower must be protected, then only one man can go on this errand, whose fate could be easily guessed. ... In many places...the distance from any supplies and, what would be still worse, not being able to procure water, or of its proving bad, would prove...very difficult to overcome. ... In the most of these jungles it would often happen...that...the whole complement of men would be... all down with fevers at the same time[5].

In August 1817 a committee was appointed to investigate the possibility "of establishing an experimental telegraphic communication between Fort William and Nagpore", and to report on the value of extending such a line if it proved successful. Mackenzie, as Surveyor General, was appointed president, with the Adjutant General, the Quartermaster General, and other military officers, as members. Amongst the many officers consulted by the committee was Lambton, who discussed at length the proposal and the possible lines.

The committee then obtained the appointment of George Everest, with Ferguson as assistant, to survey a line from Calcutta to Chunār, and select sites for the towers taking the general line of Ranken's road [I, 38]. A line following the

[1] Richard Lovell Edgeworth (1744–1817), *DNB.*, "led to invent a plan for telegraphing by the desire to know the result of a race at Newmarket". [2] Claude Chappe (1763–1805); drowned himself in well of his workshop; model of telegraph RUSI. museum, Whitehall, exbt. 6570. [3] (1761–1803), Dir. of Telegraphs, Admiralty, 1796. Bishop of St. David's 1801. [4] letter of 6–12–13; B Pol C. 4–3–14 (9). [5] DDn. 143 (73–8), 20–6–14.

Ganges was recognized as impracticable[1]. Everest's survey had reached Sherghāti by the middle of February 1818 ;

His distances average nearly 9½ miles, but, as a great portion of the country...is covered with thick forest, that average may be considered rather low, and, in fact, the distances...since he has reached the open country have occasionally been as high as 12 and 13 miles.

The surveyors were furnished with the common achromatic telescopes generally used by military men in the trenches or in reconnoitring parties. ... These...are...insufficient for a greater distance than 7 miles in the low wooded country, and somewhat more on the open plains. ... On one occasion where two of Captain Everest's stations were separated by an uninterrupted valley of something more than 13 miles in breadth, a telescope of the power of 14 afforded him a distinct view of the telegraphic spheres during eight hours of the day. ...

The height of the telegraphs is calculated with reference to the curvature of the earth, but in open countries it is endeavoured to give them an elevation, by means of isolated hills or otherwise, which will prevent the visual line from approaching nearer than 30 feet to the surface of the ground. In flat wooded country, however, that line has hitherto been nearly a tangent to the general curve formed by the intervening foliage[2].

The survey reached Chunār in May, and Everest sent Lambton a long account ;

The land between Calcutta and Burdwan is flat and swampy ; highly fertile and populous, and studded everywhere with villages in which there are almost always found trees rising to a great height, and obstructing the view. An observer standing on the ground would...never be able to extend his prospect beyond 5 miles, and very seldom beyond three miles in any direction, and it has not been uncommon to raise a platform of 70 feet, in order to view an object of 90 feet in height at the distance of 8 miles.

The whole tract is...peculiarly ill-calculated for telegraphic communication, from there being scarcely any rising grounds, either natural or artificial, so that the edifice must be raised from the ground, and the only plan...was to place ladders upon some lofty and strong-limbed tree, and ascend...to a small bamboo framework raised to the height required [264]. ...

After reaching Bankoorah [263], which is about 100 miles from Calcutta, the face of the country is divided into uplands and valleys, and about 20 miles farther westward we enter upon a wide extended plain, in which are several isolated hillocks and hills almost approaching to the size of mountains. ... 2,000 feet is far too great for telegraphic purposes because the telegraph being a dark coloured object requires a light background ; in this part of the line therefore, the eminences of 300 and 400 feet have generally been chosen. ...

After passing Chass[3], ... the very rapid rise in the land takes place which continues to Hazaribaug, the most elevated part of the new road. The peaks of Parasnath are visible through nearly 100 miles of the new road in clear weather, and the telegraph post which is nearest to the mountain is 19 miles...from the summit. ...

The fort of Chunar is...on a rock. ... The telegraph posts to the westward...have been taken up principally on the ruins of mud forts, or such other mounds as were in former days used... for protection against Pindaries.

I look forward...to the arrival of the Trigonometrical Survey in this part of the country, and particularly in the plains westward of Sheergatti, for no artificial elevation will be required, and the atmosphere is so exceedingly clear during the greater part of the year that the view may be extended to 35 or 40 miles, or even to a greater distance, without difficulty. ...

There is a peculiar vapour in the hot weather which affects the atmosphere at a less height than 100 feet, ... and causes so great a divergency in the rays of light, that telescopes of large magnifying powers are of little use, and in such situations the telegraph distances have seldom been greater than 7½ miles, whilst in the hilly tracts 18 miles has not been too great.

The distances between the telegraphs have generally been measured...by taking the contained angle between one telegraph and any conspicuous object. Thus the mountain of Parasnaut, which presents several remarkable peaks, was used to determine the distances between 6 different sites, and...a rough approximation was obtained which was somewhat better than perambulator measurement. ... There were many occasions where...the perambulator...became the only resource. The survey in fact has been a very rough one, and differs only from the generality of the route surveys in there being always an opportunity offered of seeing from one end to the other of each Telegraph line, and thus obtaining the general direction[4].

The survey was closed down on 16th October 1818 when Everest left Chunār to join Lambton at Hyderābād[5], [227, 352–3]. Temporary signal stations had been

[1] BGO. 21–10–17. [2] from Telegraph Com. to Lambton ; 26–2–18 ; DDn. 91 (157–9). [3] Chas, 73 I/2. [4] copies of W. sheets survey with telegraph rays, MRIO. 81 (37–9) ; Everest to Lambton, 1–6–18 (37–9) ; DDn. 91 (163–70). [5] BGC. 2–10–18 ; DDn. 64 (74).

erected whilst the survey was going on, and experimental signalling started, but this also was closed down ;

As the survey of the whole line from Fort William to Chunar appears to be completed, and the temporary erection of telegraphs on the point of being finished, the appointment of Captain Everest and Lieutenant Ferguson, of Messrs. McRitchie and Leake, and of Richard Wyatt[1], and generally all situations created for...surveying the road and putting up the stations in the first stage of the experiment, may...stand abolished from the 15th proximo[2].

In June 1820, Ferguson was appointed assistant to William Playfair[3], "employed on construction of the telegraph towers on the new military road" [II, 312] for a period of about 18 months. The post of Superintendent of Telegraphs was then held by—Henry Gilbert-Cooper[4] 1822 to 1824—Charles Weston [II, 454] from 1824 till his death in May 1828.

The line consisted of 45 stations each manned by 5 to 7 *tindals* and *cossids* on pay amounting to Rs. 992 a month. By November 1827 messages were being regularly transmitted between Calcutta and Chunār. A typical one despatched from Chunār at noon reached Calcutta within an hour, and its reply reached Chunār before 5 p.m. Messages were passing daily, and it was rare for one to be unintelligible[5]. Among the difficulties recorded are

clouds of dust along the whole line of the Benares road. ... The want of a second telescope, ...and the necessity of turning it perpetually from one side to another in a confined crowded room, which frequently breaks and injures the telescope[6].

Expenditure between 1816 and 1828 came to nearly five lakhs of rupees, and in a minute of 15th April 1828 Sir Charles Metcalfe, the Home Secretary, recommended its abolition as being not worth the expense, and on receipt of an estimate that future expense might reach Rs. 2000 a month, the Governor General in Council agreed, as there "seems little to set against the expenditure beyond the early gratification of curiosity". The service was accordingly brought to a close from 1st September, though left on a caretaker basis until 1830[7], and the Directors unkindly reminded the Bengal Government that on first hearing of the project they had expressed great doubt as to its practical value[8].

It was the decision to abandon these towers for telegraph purposes that made them available for Olliver's triangulation [263–4]. They were substantially built of brick, and one of them was still standing in 1950 [264][9].

The electric telegraph was not introduced into India until 1851.

NATURAL HISTORY

Natural History was still one of the sections on which the Madras surveyors had to report in their district memoirs, though since the Mysore survey botany and zoology were no longer responsibilities of the Surveyor General [II, 113–5]. Mackenzie however notices a double-headed snake in Madras, and Hodgson and Herbert report on Himālayan flora. Both these subjects were normally left to the Company's medical officers, several of whom became superintendents of the collections at Alipore and Sibpur[10].

Several distinguished Frenchmen were working in India at this period. Mackenzie was interested in Le Chenault at Pondicherry, whilst Baron Georges Cuvier of the Paris Museum sent out a succession of keen young naturalists, amongst whom were Alfred Duvaucel, Pierre Diard, and Victor Jacquemont[11].

Duvaucel was born about 1793, and married a step-daughter of Baron Cuvier. Appointed naturalist to the King in 1817. Reached Calcutta 1818, and his help in examining museum

[1] John McRitchie, arrd. Calcutta, a free merch. 1814 ; a Richd. Wyatt, m., in Bengal, 3–9–08, Miss Rita Rosebloom. [2] BMC. 26–9–18 ; DDn. 133 (399–400). [3] Wm. Davidson Playfair (1783–1852) ; Ben. Inf. ; Supt. Mil. Roads, 1813–8 ; furl. Feb. 1821–24. [4] Henry Edward Gilbert-Cooper (1784–1831) ; Ben. Inf. [5] BPC. 17–1–28 (79–81) 22–5–28 (53) ; 4–9–28 [65]. [6] BPC. 22–5–28 (53). [7] BPC. 7–8–28 (23) B to CD., Pub., 27–4–30 (266–91) ; Sketch of 3 different lines, Ft Wm. to Bankure, 28–8–28, MRIO. 51 (15). [8] CD to B. 14–11–32 (70). [9] Nibria TS. near Mahiari village, Howrah dist. ; inner staircase now collapsed. *Statesman*, 13–11–49 (13). [10] Roxburgh [I, 105] ; Buchanan [II, 384] ; Wallich [III, 48 n.2]. [11] Small type below does not indicate quotations.

specimens was acknowledged by the Asiatic Society. Met Diard and Voysey in Calcutta [266], and in December accompanied Diard to the Sunda Is. Returned to Chandernagore 1820, and in July 1821 left for Sylhet to extend his zoological collections into the Khāsi & Jaintia Hills. He returned with a fever from which he never fully recovered, and died at Madras in August 1824. Contributed several papers to the Asiatic Society[1], besides stuffed birds and snakes in spirits.

Pierre Médard Diard was born at Chateau de Labrosse, Indre et Loire, 19th March 1793. Met Duvaucel and Voysey in Calcutta in 1818 [*sup*]; with Duvaucel to the eastern islands, and then spent several years in Cochin China, where he met George Gibson, with whom he exchanged geographical information [79–80]. After many adventures he settled in Malacca. He died on 16th February 1863 at Djatti, a few miles from Batavia in Java, poisoned whilst preserving his specimens of strange animals[2].

Jacquemont was born at Paris on 6th August 1801, and sent out to India by the Museum of Natural History. Reaching Calcutta in May 1829, travelled through Upper India, visiting in particular Bundelkhand—Dehra Dūn—Simla—and Kashmir. A young man of great charm, was welcomed by both British and Indians wherever he went. Was an enthusiastic scientist, and collected an immense volume of information and new material, chiefly botanical.

He is well known for the *Journal complet du voyage de V. Jacquemont, avec les descriptions zoologiques et botaniques*, pub. 1835. Some of his correspondence was translated into English in 1834, and published under the title of *Letters from India.* Throughout his writings he makes constant reference to maps and surveyors, sometimes critical, often most appreciative.

Like Duvaucel, his health was shattered by his wanderings, and he died at Bombay in on 7th December 1832.

METEOROLOGICAL OBSERVATIONS

The keeping of daily meteorological observations, both in field and office, had long been a subsidiary duty of all surveyors, and many of them took a keen interest in maintaining their records.

Pearse had recorded detailed observations at Fort William from 1773 to 1776 [I, 361–2]. Colebrooke kept observations for over three months in Calcutta during 1787 [I, 327]. Patrick Gerard kept regular observations at Sabāthu and Kotgarh from about 1816 to 1823. Hardwicke, the botanist, sent Webb a copy of his journal in 1818, kept whilst commanding the Artillery[3] at Dum Dum [205].

Blacker was particularly interested in taking regular barometer observations at Calcutta for assisting field surveyors with correspondent observations. He started a regular meteorological observatory from 1st April 1825, with a register entered four times a day with reading of barometer—thermometer—hygrometer—ombrometer—anemometer—and photometer[4]. In 1829, in return for a copy of this register sent to the Literary Society of Bombay, Thomas Jervis sent a copy of the one which his brother George had kept at the Engineer Institution[5].

In 1830 the Surveyor General got a monthly allowance of Rs 10 for his draughtsman, W. H. Scott, for charge of the instruments and for taking their daily readings[6]. Again in 1830, he was directed to issue a complete set of meteorological instruments to

Mr. Assistant Surgeon Rhodes, who is about to proceed to the sanatorium in the Cossya Hills [Cherrapunji][7], with the requisite instruments for observing and registering the pressure and temperature of the atmosphere, together with blank forms of a meteorological journal, and such instructions as you deem necessary[8].

[1] *As R.* XIV (471–5) XV (157–162); *As J.* XIX. March 1825 (262); *JASB.* VII, Aug. 1838 (734–5). [2] Finlayson's *Mission to Siam and Hué*, London, 1826 (307–9); *Bulletin des Amis du Vieux Hué*, 1935 (51–5). [3] MRIO. M 534. [4] ib. M 414. [5] DDn. 264 (38), 19–9–29. [6] *JASB I* (23–33), Summary of meteorl. obsns. at SGO, 1829–30. [7] 4455 ft. above sea; average rainfall 458 inches; mil. sanatorium till 1864. [8] B Pol C. 29–6–30; DDn. 262 (36).

CHAPTER XIX

MAPS & MAP MAKING

Bengal — Madras — Bombay — General Maps of India — Atlas of India.

WHEN authorizing the establishment of a single Surveyor General of India, the Directors laid down as his main duties the compilation of large scale maps of all parts of India from the best available surveys, and the maintenance from these of a general map of India on reduced scale [II, 287; III, 281–3]. He was to be the sole authority for such maps, and was responsible that copies were only made for authorized persons and not unduly multiplied[1].

As the Company's territories steadily expanded, and greater interest was taken in lands beyond the frontiers, so also did the stream of new surveys continually increase; the pressure on the Surveyor General's few skilled draughtsmen never relaxed, whether at Calcutta or the branch offices at Madras and Poona.

Compilation of Bengal maps was particularly difficult because each field surveyor was entirely independent of the other ; there was no uniform system, either for the survey or for the style of drawing. Mackenzie replies to Webb, who had pressed for a draughtsman assistant [48, 367] ;

The young man who drew the map of Mysore you saw in England is now in this office, as I have brought him round purposely[2] ; & for more of the same kind we should have ample employment here. ... You do not do justice to yourself in deprecating your drawing. Your ...maps that I have seen are sufficiently satisfactory [II, 453].

The Surveyor is the person to construct the map of his own surveys ; the draughtsman is only required to take off the fair copy, & more than one copy is not required. ... In all my own surveys (for I am not a good draughtsman, any more than a good writer) I have constructed my own maps ...& then got one fair copy made.

He disapproved of a surveyor making several copies "for all and sundry". Further copies and reductions were the duty of the Surveyor General[3].

Though the Directors would not hear of any resurvey of Bengal [186, 284], the old engraved sheets of Rennell's survey were long out of print, as well as hopelessly out-of-date and inadequate, and as no copies could be made except by hand, it was almost impossible for local officials to get hold of maps of their districts. There was a dispute in 1816 between the Collectors of Ghāzipur and Benares. Barlow of Ghāzipur asked Hamilton of Benares to lend him a map of Jaunpur for an official tour[4]. Hamilton replied curtly that the map "was stretched on cloth, and hung up to preserve it", and could not be supplied ; upon which Barlow "handed him up to the Commissioner"[5].

It was a long time before the Surveyor General found the staff to compile maps on reduced scales, and, reports Mackenzie in 1819,

Complete maps of the provinces are entirely wanting, except one district, Chittagong [11]. I do not perceive any map that can be considered as fully inclusive of a province of late years. Benares, Bundelcund, Cuttack, the Sunderbunds, some parts of the Upper Provinces, and others, have been begun...many years ago, but never conpletely finished. These surveys have been repeatedly interrupted, and their materials either damaged by repeated copying, by being sent out, and in some instances none whatever sent into the office.

The copying of the surveys on their original large scale seems to me entirely unnecessary, and attended with a great loss of time and expense ; the map now accompanying is one fourth

[1] CD to B. 3-6-14 (19, 20). [2] Newman or Hamilton [312]. [3] DDn. 156 (144), 30-11-18. [4] Robt. Barlow (1788–1845), son of Adm. Sir Robt. Barlow, GCB.; offg. Collr. Ghāzipur, 1817—Sir Fredk. Hamilton (1777–1853) ; 5th Bart. ; Collr. Benares, 1816–28. [5] Dewar (331).

of the size of the original and, in my idea, comprehends everything requisite[1].

In 1822 the Board of Commissioners at Patna asked for maps

of the several districts prepared from the latest surveys. It is generally supposed that there are some objections to complying with such applications, arising, it is believed, from some old order [II, 288–92]; but, as the Government are disposed to incur considerable expense in a topographical survey[2], the Board are inclined to think that objections no longer exist[3].

The maps demanded covered no fewer than thirteen districts from Bihār to Cawnpore, and the Surveyor General replied that he could not possibly supply them without laying aside those of the extensive countries of which

we have only lately acquired a geographical knowledge. There are at present under preparation in my office for transmission to England, and for record, the following maps, and as several of them are very large, and two persons are employed on each, it is evident that great delay will take place if I am obliged to relinquish them to supply copies of...almost obsolete maps ...for...the settling of abkaree boundaries[4].

Reductions and copies were being made of the Himālayan surveys and panoramas of Hodgson, Herbert, and Webb [39–40]; a map of the countries west of the Jumna; maps on scales from 8 to 20 miles to an inch of the upper provinces; of Mālwa; Bundelkhand; of the peninsula of India; of Macartney's large map of the Punjab and Afghānistan [II, 270–1], and many others. Hodgson promised a copy of Ensign Stephen's maps of Benares, etc. [II, 36, 443], to be made for the Board; it is, however, not a topographical, but a geographical map, as are nearly all others in this office. This map was first received...on the 19th February 1819; the first sheet in rather an injured state, ... having been in constant use with the Magistrate of Goruckpoor since October 1817. The other maps...are...from very ancient surveys; they are merely of a general geographical nature, often founded, as most surveys in this widely extended country are, on military operations. ... Few, or no, surveys have been made of them since the time of Major Rennell, to whose atlas, and to Arrowsmith's map, it may perhaps be expedient to refer. ...

I annex an extract of a letter...from Colonel Mackenzie, dated the 18th September 1819 [274–5], which may...confirm the expediency of restricting...requisitions...which not only embarrass the current business of this office but seem at variance with the spirit of the orders of the Hon'ble Court of Directors...to limit the multiplication of geographical materials[5].

The desperate straits to which local officers were put from this lack of maps is well illustrated by the following appeal from the Magistrate of Ghāzipur;

The published maps of this part of the country are perhaps more defective than those of any other part of the Company's provinces. The rich district of Ghazeepoor, which abounds in populous towns and villages, is left almost a blank. This defect is supplied for a great part of the district by the excellent and recent map of Captain Stephen's [*sup*], but for the purgunnahs situated to the south of the Ganges, and those along the south-eastern frontier, ... we are left to fill up as we can the blanks left by Rennell and Arrowsmith [277–8].

The convenience of a good map for judicial and police purposes I can speak of from experience. ... We know at a glance what officer can most conveniently be employed on any special duty, and we can adjust the proper stations for our police chokees. The new settlement of Azimghur is about to commence, but the Collector has nothing on which to found his measurements or surveys, and even the sites of the principal towns are unknown[6].

Sir John Malcolm's map of Mālwa [84–6] was compiled in eight sheets, scale four miles to an inch, by Robert Gibbings, A.Q.M.G., whose draughtsmen were William Sundt[7] [280 n.3], L. I. De Mello, and possibly Arthur [?]White, who worked for St. John Blacker [85], and later for Briggs in Khāndesh [124]. The full map[8] stretched from east of Saugor to the mouths of the Tapti and Narbada. A reduction on the 8 mile scale, adjusted to the Great Trigonometrical Survey, was drawn in the Surveyor General's office in 1845[9].

During his time as Surveyor General between 1821 and 1823, Hodgson did a great deal to clear up the drawing office, and sent home to the Directors five cases of maps, journals and fieldbooks, originals and copies[10];

[1] for comdg. officer in Cuttack; DDn. 198 (69), 18–9–19. [2] The new revenue surveys of Upper Provinces [149–51]. [3] DDn. 195 (77), 23–6–22. [4] DDn. 198 (65–9) 24–4–22. [5] DDn. 196 (210) & 198 (65–9), 24–4–22. [6] DDn. 195 (252), 8–11–22. [7] MRIO. Misc. 2–O–18 [86 n.2]; full material passed to SG. under B Pol C. 1–7–22; DDn. 193 (9–12). [8] DDn. 278 (21); MRIO. 83 (67, 68) 84 (1, 2, 5, 6). [9] DDn. 278 (10, 11). [10] Typical of these is MRIO. 10 (6), Country W. of Delhi–Karnāl, 1823, 4 m. to inch : ib. 11 (33): Delhi to Jaipur & Ludhiāna, 16 m. to inch, 1822.

Knowing...the very great utility of maps on a large scale divided into separate sheets—bound together in a...large folio [278–9, 284]—I have prepared the title and following 15 pages contained in the case No. 1, and...recommend...engravings to be executed by Mr. Arrowsmith, or any other competent person, and published in the form of an atlas.

The utility of the Bengal Atlas published by Major Rennell many years ago [I, 227–30] (but which excellent work is now...out of print) has been generally acknowledged, and... the work which I now send may be esteemed valuable. It comprises a...correct delineation of the geography of countries of which no accurate maps have been constructed except by myself. It was my intention to have extended the atlas to...Central India. ...

I also annex a list of maps...prepared in this office...between the 1st of June 1821 and the 22nd October 1823, amounting altogether to 244 maps, plans and sketches[1].

Hodgson's "case No. 1" contained the first sheets of a quarter-inch atlas of north-west India, planned by him but not carried on by Blacker. "At the time of my removal from office I had struck off at the...lithographic press five sheets of this work, which have been distributed to various officers...and considered very useful"[2]. The Directors greatly appreciated these maps and proposed to incorporate them into their new Atlas, which they hoped would save a great deal of the labour spent in the Surveyor General's offices in making copies for local use[3] [292].

On the other hand they hardly appreciated the cumulative effect of their various orders. The Surveyor General had to send home copies of every survey and map ; he was forbidden to multiply copies; his office expenses and establishment were rigorously controlled. Colebrooke's recommendation that every district map should be engraved had been refused [I, 231], and yet the Directors were

surprised to find that the Collectors and Judicial authorities are not furnished with maps of their respective districts. We are not aware who is to blame for this omission, but we desire that no time be lost in issuing instructions to the Surveyor General to prepare in all practicable cases maps of the several revenue districts for the use of the local authorities, who ought to be held responsible for the safe custody of the same.

We also desire that a map be prepared for our own use shewing the boundaries of all the districts, ... as well as the sudder [headquarters] stations[4].

A map that probably met a great need at the time, though not apparently printed for general issue, and showing no roads, shows all police *thānas* and principal towns in the lower provinces, scale 20 miles to an inch[5]. The *thānas* corresponded generally with present districts, but district boundaries and even names were continually changing [154 n.5].

An interesting map of Kashmir was drawn by Alexander Gerard from materials collected by the political agent at Ambāla ; "The Valley of Kashmir, scale 3 miles to an inch". It shows, without explanation, an arbitrary boundary line across the valley just north of Srinagar. The *Oolur Lake* is shown much nearer Srinagar than to Baramula. It shows "Toshe Mydan Plain, covered with flowers", and *Ferozepoora*, but not Gulmarg[6]. Amongst many early descriptions of Kashmir is that by Moorcroft's agent, Mir Izzat Ullah [II, 431], who gives an accurate record of his marches, stage by stage[7].

MADRAS

During the two years which he spent at Madras before moving to Calcutta, Mackenzie cleared off all arrears of mapping left by the Military Institution and the district surveys. The Assistant Surveyor General was left responsible for collecting from the field parties the reductions they made of their surveys each year, and for compiling them for the Surveyor General and the Court of Directors. It was his duty to provide any maps called for by the Madras Government, but at the same

[1] DDn. 198 (131), 22–10–23. [2] DDn. 231 (49), 5–11–27. [3] CD to B. 13–10–24 (15). ; ib., Gen., 30–4–28 (33). [4] ib. 22–12–30 (8) ; Hodgson's maps include Hooghly & Midnapore dists., ¼-inch, 1824–9, MRIO. 38 (9–10, 19–21). [5] ib. 41 (3, 4). [6] ib. 8 (24). [7] tr. & pub. as *Travels in Central Asia*, Calcutta, 1872 [II, xxvii] ; extracts, *Oriental Qy.*, BM. PP. 3799, 3 (103–21, 285–302) ; 4 (126–40, 285–98).

time to respect the Surveyor General as the sole authority for the production of maps [274]. Mackenzie was exceedingly jealous of his duties in this respect, and insisted on being kept fully informed of all such work.

Little could be done from Madras to provide maps for the campaigns in the Deccan, 1816–7, and Blacker, as Quartermaster General, had to rely mainly on his own staff. Mackenzie explains to the Commander-in-Chief the delay in supplying maps ; only three draughtsmen were allowed ; and these could not cope with the demand even when assisted by field surveyors[1]. In May 1817 he tells Blacker that

the copies of the 5 Military Divisions [II, 276, 292] were sent in some months ago. ... By your applying at the Secretary's you could get them. There is a General Map of India published by Arrowsmith last year[2], for which he was supplied by the Directors with the latest materials [287–8]. ... This map would be more useful to you for general purposes than any other. The maps of the 5 Divisions contain it more at large, but that of the Circars is still very defective.

The late surveys of the Ceded Districts [152–6] were in November in the hands of the engraver, so that you can have recourse to them at length when they come out ; next year I suppose[3].

Mackenzie was astonished that Mountford found little drawing to be done ;

I am surprized you should want employment for draughtsmen—fair copies of all provincial maps, of the best old maps of roads, for books of the surveys reduced to 2 and 4 miles [to an inch]—...All this I pointed out as proper objects when Government do not required plans[4]. ... There should certainly be abundance to do at all times. All surveys that come in to be copied...for England and for this Presidency, and...reduced copies of collectorships when ordered ; copies of partial surveys coming in ; reductions to the general scales of 2 & 4 miles.

When (if ever) there is no work of that kind, nor copies required by Government, my intention was that the draughtsmen, convalescent surveyors, and...apprentices, etc., should be employed in copying such of the maps in depot as were considered most essential for preservation. The practice also improved their style of drawing ; but still, if you should not have employment for the draftsmen, I imagine Government will not object to reducing any part you think necessary. You will weigh this well tho' before you propose it, and reflect it may not be easy to recruit the drawing department if any extra work is required[5].

He was indignant at demands made by De Havilland in his capacity of Inspector of Tank Estimates, a new post under the Revenue Board. De Havilland had always been an enthusiastic map-maker [II, 276, 280], and it was natural that with a job that extended throughout the presidency, he should want both detailed and general maps, but Mackenzie would have none of it.

I do not understand this plan of De Havilland's. He has some view, but what it is, and who are his coadjutors at the Revenue Board, I cannot guess at. It would be of importance that I knew. ... As to making a map for publication it would be out of the question ; ... the value of money is too well appreciated to be lightly sacrificed. No map for 20 years at least can come in competition with Arrowsmith's [287–8] with all its defects, as the engraving is so very expensive, so that it is a project not to be meddled with. The India Company also set their faces against it. ... De Havilland has some other scheme in view, as it is said he has [the intention] of going home. ... He wishes to acquire éclat as a geographer, ... for he is an... enterprizing man, tho' I wish it had been tempered with more discretion in this case[6].

Mountford had already protested at De Havilland's request for material

to finish satisfactorily a map of the Peninsula. ... This office has...been declared to be the only repository of these materials...from whence all geographical information is derived. ... Original materials, which are in a constant state of examination, reduction and reference, could not be issued...without putting a stop to the operations[7].

On this it was ordered that De Havilland should have his map constructed in the Surveyor General's office, a decision applauded by Mackenzie ;

I much approve of your late letters about this new manufactory for the Revenue Board. ... Let me know what answer you get. If any single plans are called for by the Revenue Board, if Government order, then it is your business to obey ; but this new mode of putting an officer in correspondence to demand, if he pleases, all or anything, I cannot understand[8].

All your official letters are come. Government have judged correctly ; ... but, in allotting it as a duty to you, they have forgot that the construction of general maps is not, and was not intended to be, the duty of any other office than the Surveyor General's. ...

[1] DDn. 156 (26), 3–4–16. [2] 16 m. to inch. [3] ib. (120), 1–5–17. [4] DDn. 149 (37), 27–1–19. [5] ib. (41), 23–2–19. [6] ib. (85–9), 13–8–19. [7] DDn. 148 (114), 3–6–19. [8] DDn. 149 (75), 4–7–19.

Take such preparatory measures as may be necessary but...the Revenue Board ought...to state the necessity of this new map—What objections they have to the general map done by Captain Warren so much to their satisfaction in 1811 [II, 277]?—What purpose it is designed for ?—... Take care that none of the surveys or maps in your office be again exposed to be damaged, for this construction...appears to me altogether unnecessary. ... I will object to any surveys being introduced into their map excepting what is under their management[1].

After protests from De Havilland and the Revenue Board, it was ordered that as De Havilland had already completed a large part of his new map from the district maps, and as it was not of the high quality required by the Surveyor General's office, he should complete it from such materials as he could collect in the Tank Department. The struggle was not yet over, and in 1827 Montgomerie was still refusing to lend original documents to the "Inspector General of Civil Estimates".

We have already noted Mackenzie's jealousy of Russell's efforts to get better maps of the Nizām's territories [116]. He particularly resented the request of the Madras Government for "as full a map as can be prepared...of the country between the Tombuddra & Nerbudda", and Russell's complaints of delay ;

The Resident of Hyderabad complains that his requisition for geographical information is...not complied with. It becomes absolutely necessary for the vindication of the office that the cause of that delay...be satisfactorily accounted for. On the 11th of July last year the Resident wrote me a private letter on this subject, ... & as...the Government had of 30th July directed you to furnish a map, ... any further order from me was unnecessary. ... Mr. Russell's own private correspondence sufficiently accounts to me for your deferring it, but...Government should be satisfied. ... I beg you will not longer defer the map required.

I think Mr. Russell has acted very inconsiderately in desiring you to...wait for any materials, & at the same time complaining of want of ready communication. ... For the delay in this map you will be expected to account, & if it has been sanctioned...all is well. For God's sake write soon & *do not be applying for materials*. ...

No Resident in India has required so much, or been furnished with so much[2].

It is natural that Lambton, who was in close touch with Russell at Hyderābād, should sympathise with his impatience [116] ;

It is easy to discover the source of these objections, and it has in a great measure been from such grovelling principles, and the jealousy of Departments, that we are at this day almost entirely ignorant of the geography of countries of which we have been in possession for upwards of forty years. I was much surprised when I first crossed the peninsula to find that Arcot was upwards of *ten* miles out in its position, and, according to the Requisite Tables[3], Hyderabad is no less than 11′ out in latitude and 32′ in longitude [226]. This, however, may be wrongly recorded in the...Tables ; but every place that I have been at is so much out as to render the maps and plans nearly useless [pl. 17n].

I consider the Nizam's country as the great military key of India, and are we to remain ignorant of its geography for fear of exciting the jealousy of an individual ?

He points out the large demand for his map of the south peninsula [II, 277, pl. 17] ;

Fortunately I have preserved a copy of it in my office, otherwise it would have passed from one tracing-glass to another till at last its copies would have become so distorted as scarcely to resemble the original[4].

In 1822 Hodgson commissioned Mountford to compile a new map of the peninsula, scale of 16 miles to an inch, based on Lambton's triangulation, to comprise "all the Honorable Company's possessions which have been regularly surveyed", and "the territories of His Highness the Nizam...as far as the regular survey...has been conducted". The map was submitted to Calcutta by the end of 1823[5].

Another map that Mountford had in hand at this time was "an atlas for the use of the Revenue Board[6], and it was from this quarter-inch atlas that he was able to prepare a duplicate 16-mile map for the Surveyor General ;

I...propose carrying on this work and that of the map for your office together ; for, as the former will be in sheets embracing the country falling within one degree of latitude and longitude, the reduction will be simple, ... and nearly the same surface of paper will embrace four

[1] DDn. 149 (79), 9-8-19. [2] to Riddell, 13-7-18 ; DDn. 156 (359). [3] by J. Winorie, annual, 1804-36. [4] to Resdt., DDn. 92 (43), 21-5-18 ; cf. MRIO. 144 (4), General Map of Peninsula, scale 8 m. to inch ; S. of 17°. [5] DDn. 197 (96) & 200 (164), 1-9-23 ; S. India, 12 sheets, 16 m. to inch, 1823, *IO. Cat.* (85). [6] commenced on letter from Madras Govt., 3-7-19.

degrees of latitude and longitude, or sixteen square degrees. These sheets may afterwards be pasted on cloth, or put up in the shape of an atlas, which I consider preferable for office use, as it admits of easier correction, and is also much more convenient to copy from[1].

About this time more draughtsmen were engaged, in order that "maps on different scales, and for various purposes, should be constantly ready" instead of waiting till copies were called for[2].

The quarter-inch atlas for the Board of Revenue was a long business, and under Montgomerie gave way to the new Atlas of India [284], Hodgson suggesting that Arrowsmith's map on the same scale was "a very useful work" and should "answer the purpose required by the Board"[3]. It was, however, resumed later, and final sheets were submitted in 1830. These were only single copies, and the issue of printed maps to all officials had to await the engraved sheets of the Directors' atlas. During 1826 Montgomerie had in progress ;

(1) An Atlas for the Hon'ble the Court of Directors, on a scale of 4 miles to an inch. ...
(2) An Atlas for the Board of Revenue, on a scale of 4 miles to an inch, to comprehend every detail in the original plans...of those provinces immediately under the Government, with a skeleton only...of those territories by which the former are surrounded.
(3) Map of the Guntoor collectorate, on the scale of 2 miles to an inch, for the use of the Collector.
(4) Map of Mysore and Coorg, on the scale of 4 miles to an inch, for the use of the Resident.
(5) Map of the Neelgherry hills, scale 2 miles to an inch, for the use of the Collector of Malabar.
(6, 7, 9) Maps of Collectorates of Trichinopoly, Lower Canara, and Cuddapah, for the use of the Collectors, scale 2 miles to an inch.
(8) Plans and documents of construction of the surveys of Madura, Coimbatoor, and Tanjore collectorates, the originals...sent to Calcutta.
(10) A set of Military Division maps for His Excellency the Commander-in-Chief, on the scale of 12 miles to an inch.
(11) Map of Travancore and Cochin, ... scale...4 miles to an inch, for the Quarter Master General[4].

Many of these maps had been ordered five or six years earlier, and on Mountford's asking leave to withdraw surveyors from the field to push them on, Government had replied that geographical information should be supplied

to those public departments to which it is calculated to prove useful. On the other hand, ... progress of the surveys not yet complete should not be interrupted. ... Ultimately the Board of Revenue should be furnished with a complete set of maps of the provinces under their superintendence, but...the advantage to be derived from them is not so great as to justify any material additional expence, and still less the interruption of any survey[5].

As in Bengal, there were constant demands from district officers for reliable maps, and the usual answer was that a map had been supplied ten or twenty years ago which should be good enough. The Collector of Tinnevelly, 1827, did not agree that Robinson's survey of 1807–13 [II, 141–6], was of any value ;

The district map...in my cutcherry is of old date (January 1816), and in point of execution much inferior to others. ... The watercourses are in some cases imperfect, and in others not marked, and none of the anicuts[6], either new or old, are laid down. The mountains which form the western boundary...are...not represented with sufficient detail, and there is no notice of the bearing or distance of any place beyonds the bounds of the district. ... It is moreover in a state of actual decay, not having been either varnished, or evenly stretched on the canvass to which it is attached ; the surface has in some places been rubbed off[7].

Montgomerie was neither sympathetic nor helpful ;

Another copy would not be found at all to differ from the map now in the possession of the Collector, excepting perhaps in point of execution. It has not been customary in the compilation of districts maps to insert any detail beyond the boundaries of the districts, and... no maps issued from this office are ever varnished[8].

BOMBAY

After the abolishment of his office as Surveyor General, Williams still remained responsible for the supply of maps to his own government, though not representing the Surveyor General at Fort William. His main task, self-imposed, was the extension and revision of Reynolds's great map of Western India [II, 282–5], and

[1] DDn. 200 (205), 11–11–23. [2] ib. (51), 15–5–23. [3] DDn. 220 (184–92), 30–11–26. [4] DDn. 222 (2). [5] DDn. 192 (175), 3–7–21. [6] masonry dams [I, 95 n.6, etc.]. [7] DDn. 222 (140–3), 8–5–27. [8] ib., 9–6–27.

in his capacity as Revenue Surveyor at Broach he maintained a drawing office, with a depot of survey and mapping material from which he produced copies of any areas that might be required. He writes to the Chief Secretary in 1817, before the final break with the Peshwa [I, 124–5], that he could furnish

a map of the Paishwa's dominions on a large scale, that will exhibit a very comprehensive view of the geography of the country, and will contain...the greatest part of the towns and villages, both large and small. But I am not in possession of plans of any fortifications, or of written information on the towns and villages, ... neither can I show the boundary lines of the different internal divisions of the country, nor those between the territories of His Highness the Paishwa and other States of his Tributaries.

Captain...Johnson's map of the Deccan [II, 165], which may be useful, ... shall be forwarded to you immediately by sea [from Surat]. A map of the whole Concan, from the Damaun River, north, to Goa, south, has been compiled in this office on the same scale as the map of the province of Guzerat, viz., 18 inches to a degree, & is forwarded herewith[1].

Reynold's map was revised on the scale of 9 inches to a degree under the title of *A General Map of Hindustan*, and was completed, mainly by William Webbe, in 1821, when Williams offered to present it "in person to the Most Noble the Governor General of India, for whose use it is intended, and for which purpose I have been indulged with leave to proceed to Calcutta"[2]. Disappointed, however, at not being selected to succeed Mackenzie as Surveyor General [300, 322], Williams abandoned his intention of taking the map in person, and sent it round by sea [I, 219]. After careful examination, Hodgson came to the conclusion that, in spite of the time and labour expended, it was not sufficiently complete or up-to-date to be worth publication [II, 285 ; III, 287].

In a memorial submitted shortly before his retirement, Williams pressed for the grant of Surveyor General's allowances for the full period since 1815, on account of his continued work as sole survey adviser to the Bombay Government. He gave a full list of the various maps which he had furnished during these five years, mostly on the scales of 9 or 18 inches to a degree, the scales used by Reynolds. Amongst them were ;

Map of the eastern borders of Guzerat, with...Meywar, complete. To the Resident of Baroda ; ... on a scale of 18 inches to a degree[3].

Copy of the General Map of India by General Reynolds, on scale 9 inches to a degree, for the Supreme Government [*sup*].

Map of Goojerat & Kutch, improved by late surveyors ; ... 18 inches to a degree ; extending from Damaun to the eastern branch of the Indus.

Copy of Major General Reynolds' surveys of the Rivers Tapty and Nurbudda, containing all the intervacent countries. For Colonel Smith, commanding the Poona subsidiary force in the field [cf. II, pl. 15].

Map of the whole Province of Goojerat, including Kutch and Choorwagur. 18 inches to a degree. For the officer commanding the Province.

Map of the Northern and Southern Konkan on 9 inches to a degree, for the Resident at Poona.

Map of the dominions of the late Paishwa in the Dekhan, the Konkan, Kandees, and Goojerat. Extending from the Sautpoora mountains, north, to the Maulpurba River, south. To the sea, west, and to 76° 25′, east. ... For the Honorable the Commissioner in the Deckan.

Map of Malwa, Maywar, Harrowter, &c., extending from the 22nd to the 27th degree of latitude, ... on a scale of 4½ inches to a degree. Supplied to the Resident at Baroda.

Plan, with remarks annexed, of the route pursued by the Bombay Mails between Bassein and Ahmedabad, on a scale of 2 B. miles to 1 inch ; explaining the nature of the crossing places of all the rivers ; showing the stations of the runners where the route leads through the territories of other Governments [28, 269].

Report on the chiefs residing along the Ghauts...& the comparative facility of the different passes...for the admission of banditti, either inhabiting the mountains themselves, or coming from the upper country [82].

Report accompanied with a sketch on lines for telegraphic communications through India. To the Telegraphic Committee, Calcutta [269–72].

Map for the Collector of Ahmedabad, containing, as well as the whole of his own collectorship, also that of the eastern zillah north of the Mhye, showing the boundaries of each, and a considerable portion of the adjacent country in every direction, on a scale of 2 B. miles to one inch. Size 9¼ feet long by 6¼ feet wide.

Two maps of the province of Khandeis, one on a scale of 9 inches to a degree, to show the whole extent of the soobah as it originally stood, and the other on the largest scale of General Reynolds' work, vizt., 18 inches to a degree, to exhibit...as accurately as the office materials would allow the possession of the different powers as they stood before the late war[4].

Williams had no hand in Malcolm's map of Mālwa [85–6, 275], nor in the mapping of Sutherland's surveys in the Deccan [124–5].

[1] Bo SC., 3–6–& 30–8–1817. [2] Bombay, 24–6–21 ; Bo MC. 26/1820 (104–8) ; maps, 9 and 16 inches to m., for Reynolds' atlas, *IO Cat.* (84–5). [3] cf. MRIO. 94 (20), from Reynolds ; sd. by Williams, April 1818 ; drawn by Wm. Sundt ; 12 m. to inch. [4] from Williams, 15–6–20 ; Bo MC., 28–6–20.

On his retirement Sutherland was appointed Assistant, and later Deputy, Surveyor General [323], and regular correspondence was then opened with the Surveyor General at Fort William, but it was not until 1825 that Blacker learned that, except for Reynolds' map and "those of the Revenue and Marine branches", no Bombay maps or surveys had been sent home to the Directors[1].

After succeeding as Deputy Surveyor General, Jopp suggested that he should entertain more draughtsmen, and relieve the field surveyors from the drudgery of mapping [126, 284, 393]. The only draughtsmen hitherto maintained had been Webbe and Sundt [323]. He was allowed to entertain eight extra draughtsmen

for the preparation of the maps required for the Surveyor General of India [292]—to provide for the correct compilation of the surveys now carrying on, and the making of copies of them for...Calcutta and for...local officers under this Presidency—as well as to ensure...a more immediate compliance with the orders of Government—and the progressive improvement of our old maps by the incorporation of such new...information as may hereafter be collected[2].

The Surveyor General also called for a reduction of all Bombay surveys on the 16 miles scale, which he sent home with a similar reduction of the surveys of the Nizām's territories, suggesting their incorporation " by Mr. Arrowsmith in a new map of India which he is now preparing on this convenient scale [287–8]". He also sent an 8-mile map " of the Southern Mahratta Country which, if separately engraved would be very useful to the local authorities"[3].

A small scale map of western India appears as frontispiece to the second volume Grant Duff's *History of the Mahrattas*, under the title *Map of Mahrashta*. The scale is about 3 inches to a degree, and it covers an area between 15° and 23° N, and 72½° and 80° E. Grant Duff acknowledges it as the work of

Captain Henry Adams, Revenue Surveyor to the Raja of Satara [171] ; ... Captain Adams is the compiler, in many parts the surveyor. ... I regret the necessity for its reduction from a scale of 6 inches to a degree ; ... still, the situations and distances are...more correct than those of any map of that country hitherto published.

The original materials for Captain Adams' map were procured from his own surveys, from those of the late Captain Challen...[and] of the late Captain Garling, ... and which last were sent to me by Lieutenant Frederick Burr of the Nizam's Service, filled up in many places from his own routes. Captain James Cruikshank...furnished me with such information as the records of the late Surveyor General, General Reynolds, afford, and with Sir John Malcolm's map of Malwa, which although then unpublished that officer readily allowed me to use. Finally the Court of Directors granted me permission to publish[4].

A map signed by Jopp in July 1828, under the title of *Map of the Western Part of the Continent of India*, was lithographed in the Quartermaster General's office at Bombay in March 1838, on scale 10 miles to 1 inch.

GENERAL MAPS OF INDIA

Although it was laid down that the Surveyor General should maintain a general map of India on reduced scale, "in a progressive state of improvement" [II, 287], neither Mackenzie nor his successors ever found time for so formidable a task.

The last of the personal general maps that the Directors were so anxious to discourage [II, 286] was that of Charles Reynolds, scale 9 inches to a degree, or about 7½ miles to an inch, on which Williams continued to work till 1821 [280]. This enormous map comprised 36 sheets, extending from Cape Comorin to Kashmir, and from Karāchi to Chittagong, and measured 22 feet by 17. The full set that was sent to Calcutta in 1821 has not been found, but 18 sheets of the 1808 set are still preserved [II, pl. 3][5].

Mackenzie was too much occupied with original survey to encourage preparation of general maps, but he laid down that the scales for geographical maps should be 8, 12, 24 and 48 miles to an inch. For his own surveys he prepared maps of Mysore

[1] Bo MC. 11–10–25. [2] ib. Poona, 29–4–26. [3] DDn. 231 (68), 3–1–28. [4] Grant Duff (preface).
[5] sd. by Williams & sent to Calcutta, 1809.

and of the Ceded Districts on 12 and 24 miles to an inch[1] [II, pl. 11 ; III, 296]. For his "general plan and view of the state of the provincial surveys" of Madras, which he submitted both in 1810 and 1815, he used the 48 miles scale[2], and this was also used for the indexes submitted in 1821 and 1823[3]. These index maps were not, however, serious geography.

A more useful geographical map, also on the 48 miles scale, compiled at Madras in 1817, was entitled, " Map of the Countries included between the parallels of Madras and Delhi, designed to exhibit at one view the capitals of States & of Provinces"[4]. This was probably prepared to meet the request of the Directors for

> a sketch map of India on a moderate scale, describing the course of the principal rivers, and the situations of the principal cities of the peninsula, together with the names and positions of all military posts at which more than five companies of troops may be stationed, and that the Adjutant or Quarter Master General of the Army may...be directed to insert in words and figures under each military post, the number and description of troops stationed at it. We desire that such a map may be transmitted to us annually[5].

A particularly interesting political map was prepared by Mackenzie in 1820, scale 64 miles to an inch, with a schedule of provinces and States, giving their areas, and dates of cession to, or treaties with, the Company. On this same scale also is a general map that was lithographed in 1829, and used for illustrating the progress of surveys considered fit for incorporation in the Atlas of India[6] [pl. 24].

Of the maps compiled for Blacker's *Memoir* of the Marātha war [86] a manuscript set is now preserved in a folio that may have been for his personal use. There are nine sheets on scale 8 miles to an inch covering the whole peninsula south of 20° N., with a northward extension to 30° N. between 73° and 82°½ E., with title,

> A General Map of Central India, comprising the Nizam's Dominions, the principal territories of the Mahrattas & Rajpoots, with parts of the British Possessions & Minor States under British Protection, prepared from original materials by V. Blacker, Madras, 1st Jan. 1821[7].

The sheets covering the south peninsula shew the fuller detail derived from the work of the Military Institution and the district revenue surveyors [pl. 24]. For the central area, north of parallel 15°, there is a separate map, about 64 miles to an inch[8], that is probably the most complete map of central India of this period. This is reproduced in Blacker's *Memoir*[9], and was incorporated into the 25-mile map of India engraved by Cary "in six large sheets" [289].

Blacker was a man of ideas, and was the first to propose a map of Southern Asia, that was put in hand some sixty years later. He points out the want of

> such a general map of so much of Southern Asia as would show at one view the relative situation of India to all the countries much connected with it, both to the east and west. A map of India is too particular for this purpose, and a map of Asia is too general, whilst the limits that I propose would comprize China to the east, and Persia to the west, Malacca and Singapore to the south, and sufficient to the north to include all such geographical informations as may be expected from the enterprizing research of Dr. Moorcroft [44]. ...
>
> The scattered materials from which it will be prepared cannot be collected in a short time, and its progress moreover depends on the occasions of leisure which...my office establishment may enjoy between more pressing exigencies of the public service. ...
>
> Recent and accurate marine surveys of the Persian Gulph and of the coast of Mekran have been completed under the orders of the Bombay Government, and...would be a great acquisition to my undertaking [133][10].

ATLAS OF INDIA

The orders issued by the Directors regarding the responsibilities of the Surveyor General of India with regard to mapping [274] were that he was to compile first a series of maps, bound by lines of latitude and longitude, on a comparatively large

[1] MRIO. 132 (9), etc. ; MRO. Map 204. [2] MRIO. 135 (31) ; MRO. Map 18. [3] MRIO. 135 (33). [4] ib. 97 (4). [5] CD to B., Mil., 16–4–17 (42–3) ; cf. MRIO. 95 (22), Divisions of Army, 1830 ; 32 m. to inch. [6] MRIO. 94 (21) ; 125 (8, 9) ; 135 (37–8) ; Misc. 1–O–29. [7] ib. 97 B (5–13). [8] ib. (4). [9] Blacker, II (pls. 2–4). [10] from SG. 3–8–25 ; Bo MC. 19/1825 ; BMC. 12–8–25.

scale—and secondly, a small-scale general map of India—both to be kept continually up to date. Copies of improvements effected were to be forwarded to the Directors with suitable explanations [II, 287].

This mapping did not run according to plan owing to the lack of sufficient draughtsmen to cope with the fresh survey that was continually pouring in [274]. It was not long before the Directors realised the urgent need for a continuous map of India, on uniform scale, in uniform style, and that this was more than the Surveyor General could accomplish in India. Arrowsmith had compiled the surveys of the south peninsula into a general quarter-inch map [288], and the Directors were anxious to produce a similar one for the whole of India. Markham tells us that "Colonel Salmond, then Military Secretary[1], was for some years in consultation with Colonel Mackenzie, the Surveyor General at Calcutta, on the subject"[2] [286], but the earliest official reference appears in a letter of 29th October 1823 ;

We are extremely desirous of forming...a complete Indian Atlas upon a scale of 4 miles to an inch, ... the best suited to general purposes, and which has been adopted by Arrowsmith in a recent publication. ... This map would...form an useful...basis for a complete geographical delineation of India [2, 281]; and it is our intention to have the several sections...printed off by some eminent map engraver, as fast as...satisfactory materials shall be supplied to us. We have caused enquiry to be made of that distinguished geographer Major Rennell, and we transmit...a copy of a memorandum...received from him [I, 376–7 ; III, 185]. ...

You will, of course, have those parts of India first surveyed, the geographical knowledge of which appears to be most important. Each survey will be printed as soon as received, and added to the Atlas, numbered according to its situation in the sketch, and in this way we may expect within a reasonable period of time to obtain a map of India[3].

Whilst Blacker firmly rejected Rennell's suggestion of building up this atlas from a rapid survey based on astronomical observations [185], he took immediate steps to assess the worth all existing surveys. An essential condition, in his opinion, was that they should have been linked to Lambton's work [240–1], and at his request Montgomerie made an exhaustive report on the surveys of Madras [120–1].

To ensure that all material should be uniformly prepared, ready for engraving, Blacker drew out a graticule based on the projection used for the French military map *La Carte de l'Empire Français* [294–5]. He was, however, unfortunate in misunderstanding the intention of the Directors, who had not wanted special maps to be compiled and drawn in India ; they had already started work on a projection and lay-out devised by Arrowsmith in England[4]. Aaron Arrowsmith had died in 1823, and arrangements were made at the India House with John Walker "for the engraving & printing. ... Copies of the maps so printed to be disposed of to the public to defray the cost, as for the marine charts"[5]. The material already available and suitable for engraving included surveys of

Kumaun, Gurhwal, etc., by Captain Hodgson, Webb, etc.—Bhopal, by Lieut. Johnstone —Bundelcund, ... by Captain Franklin—Country from Palamow to Rewah, by Captain Smith —Collectorate of Masulipatam, by Messrs. Hamilton and Summers—Dindigul Province, ... Colonel Mackenzie—Principality of Kodugu [Coorg], ... Lieut. Conner—Sketch of...Soonda, ... Col. Mackenzie & Capt. Garling [pl. 24].

We have also Col. Mackenzie's survey of Mysore and the Ceded Districts, as well as a map of the southern provinces of Tinnevelly, Madura, etc., on the same scale of four miles to an inch, and a survey of Guzerat by Col. M. Williams on a scale of two miles to an inch [II, 173]. We have likewise received from Captain Hodgson several reduced surveys on a scale of 16 miles to an inch [278–9]. If the originals of these maps have been constructed on a scale of 4 miles to an inch, or on any larger scale, ... copies...may be immediately transmitted[6].

These and other Madras surveys showed how much was available and how much still wanted to complete a general Indian Atlas. You will take immediate measures for having these deficiencies supplied by the Engineer officers of your several Presidencies, who have been specially educated with this view under Colonel Mudge and others [330, 340].

[1] James Hanson Salmond (1766–1837) ; Ben Inf. ; Mil. Sec. to EIC. 1809–37 ; M Gen. 1837 : portrait at IO., Foster (49). [2] Markham (405). [3] CD to B., Mil., 29-10-23 (47–54) ; DDn. 90 (21). [4] but not the lay-out shewn on Arrowsmith's ¼-inch Atlas of South India [288]. [5] Com. Cor. 2-6-25. [6] Cheape's survey of Chittagong also accepted.

It will not, however, be necessary, at least at present, to resurvey Bengal, Bihar, or any of the territory formerly surveyed by Major Rennell [186, 274][1].

In furtherance of these orders, the Surveyor General, now Hodgson, sent instructions to Madras and Bombay for the preparation of quarter-inch degree sheets on the projection devised by Blacker—to Madras ;

The drawing establishment should be augmented and...it may be...necessary to engage more apprentices...[279]. ... If the preparation of the atlas for the Board can be dispensed with [278–9], that for the Directors may...be commenced. ... The work is a great one, and will occupy a considerable time, ... but the sheets finished may be transmitted to me at half-yearly intervals as opportunities occur of sending them safely.

As to the form, ... the most convenient appears to be to make separate sheets, ... each...one degree of latitude and one of longitude. When bound the portions will form the left and right pages of the book, and...not...too large to be conveniently carried [276]. ...

Drawing...ought to be as clear as possible ; the names of places written in a strong hand, and all principal roads...well defined by double lines, and by-roads by a strong single line. Very distinct delineation is desirable, and too much ornamentation and crowding is to be avoided[2]. ... It will hardly be necessary to insert the very small villages and hamlets as you would in a map intended for revenue purposes only, but every known communication and road must be marked, and...as many villages near it as can be written without much crowding. ...

The drawing of the heights should bear some regard to their comparative elevation, but if the lines are made too dark, they...give a confused appearance, and...obscure the names. ... It will, I think, be better to abstain from the use of colours, and to use only indian ink ; by doing so the engraver will see more clearly what he is to execute[3].

—to Bombay ;

You will...at the close of each season...send...copies of all maps...on a scale of 4 British miles to an inch, with a full memoir regarding the construction, ... describing the methods and instruments employed; and also inform me what means...you have for digesting and compiling an Atlas of...the west side of the continent of India...(not including Malwah) ; each sheet to contain one degree of latitude and one of longitude. ...

Commence the work in a regular gradation ; ... the neighbourhood of the Presidency seems most immediately desirable to be completed. The atlas is required from me by the Government in England, and I send you a graticule...for its construction[4]. ...

The first consideration appears to be how to increase the number of draftsmen [281]. ... It is not intended that the progress of the surveyors in the field should be impeded, but, on the contrary, it is expected that the surveyors will use their utmost diligence [126][5].

Both Blacker and Hodgson had understood that sheets of the new Atlas were to be compiled in India, and sent home to be engraved exactly as they stood, and it was not till 1828 that it was made clear that the Directors wanted the surveys just as they were submitted by individual surveyors[6] ; no compilation was to be done in India. Hodgson had written to Montgomerie that,

on further consideration of the Court's late letter, it does not appear so clear that they order us to make it here, but rather they seem to want materials for something they are doing in that way at home. ... Our best way will be to send them the materials...on 4 miles to the inch. ... It is no slight work, but...we shall, I think, be obeying the letter of the order. When the work is cleared off, we can consider...a more perfect Atlas than they can make at home. I would, indeed, begin on it now, but that...they...may be impatient[7].

Though this was the correct interpretation of the Directors' wishes, Hodgson was still in two minds, and ten days later quoted another order implying that the Atlas was to be completed in India ;

It is a heavy work indeed, and exceedingly so under this Presidency, where so many and large additions have been made to our territory on every side, north from the Nurbudda to Thibet, with the addition of all that we have visited during the late eastern war[8].

He now abandoned degree squares in favour of Blacker's lay-out ;

The largeness of the sheets is an advantage, ... and in the countries north of the Nurbuddah, where the extent both in latitude and longitude is so great, it is better to see as much as possible

[1] CD to B. Mil., 25–5–26 (71–6); DDn. 217 (22–6); 220 (181–3). [2] Conventional signs by Montgomrie, DDn. 220, *c.* Dec. 1826. [3] DDn. 220 (184), 30–11–26. [4] ib. (172), 21–10–26. [5] ib. (178), 23–11–26. [6] The Directors expected that actual survey would be on ¼-inch scale [286]. [7] DDn. 223 (44–6), 8–2–27. [8] ib. (47–52), 16–2–27.

at once, for much consideration and comparison are requisite in bringing many surveys of different degrees of merit into one harmonious construction.

On your side, with the triangles to aid you, you work with more advantage, but here we have lines, routes, and surveys, from Peishawar to Amerapoora, to string, connect, and compare. It is, however, curious and pleasant to see how well they do work together in general. ...

I...hope you will not find the construction on the large sheets troublesome. I have made well-seasoned drawing boards for my sheets, and think you would find them convenient[1].

Another letter now arrived from home calling for a complete list of all geographical material available in India, and asking that care should be taken that on every map or survey "the lines of latitude and longitude may be carefully specified and correctly drawn, several copies of maps having been received by us without that ...necessary information"[2]. Hodgson was thoroughly puzzled, and asked

whether this great work is to be effected by the Surveyor General here, or whether he is to send home detailed documents that it may be compiled in England. ... The projected Atlas will be...the greatest geographical work ever undertaken, and the expense attending the engraving ...of so very large a map (as it will contain 1211 square feet of paper) will be heavy, and some years must elapse ere the work can be completed. ...

As it appeared to me...that it was intended that the Atlas should be constructed here, and as the best means...are...unquestionably those in the hands of the Surveyor General of India, I immediately took measures for proceeding with the work here. ... Six sheets...are now in hand here, and at the other presidencies the work is also in progress. ...

I have received...an extract of a General Letter dated 2nd May 1827. ... From this, and from the fact of six engraved sheets of maps sent home by me October 1823 [276]...have been published by Mr. Horsburgh, the Hydrographer, it appears to me that an Atlas is in preparation at home. Under these circumstances I do not know how to act. ...

The Surveyor General of India, knowing generally the...circumstances under which the different surveys have been made, the character and abilities of those employed to make them, and many other particulars, ... will be better able to fit such materials together than any Hydrographer...in England—who can have little idea of the varied modes necessary...in...this vast country—who never marched with armies—...who has not been compelled to have recourse to the various shifts and inventions which necessity alone suggests to officers actually engaged ...—and who must ever be ignorant of many terms and allusions used in the unpremeditated journals and field notes of the oriental surveyors. ...

If the Court would send out a good engraver, with one or two journeymen, and a complete ...apparatus, particularly prepared copper plates of the size of the sheets, ... the Atlas will in due time be executed more expeditiously and correctly than it could be in England[3].

By April 1828, seven sheets had been completed in London, and a meagre 20 to 40 copies sent out to each Presidency[4] [288]. Each sheet was about 39 inches by 27, on a "globular projection" proposed by Arrowsmith [283, 295, pl. 24][5]. By August the same year, Madras had completed and submitted five sheets to the Surveyor General on Blacker's lay-out[6], and these were followed six months later by seven more. Bombay submitted two sheets and had three others in hand.

The misunderstandings and resultant duplication of labour were at last cleared up by definite instructions from the Directors. They wrote to Madras ;

We desire that such a work be not persisted in. To the attempts that have at different times been made by the Surveyor Generals at the several Indian Presidencies to construct maps embracing a large extent of country, and the consequent retention of documents in India, we impute the little progress that has yet been made...of a general Indian Atlas.

All projects of that nature begun in India have failed from the supervening sickness or death of the projectors, or from other obstructions. ... The requisite documents having been retained in India contrary to our reiterated orders, we have been prevented from taking the necessary measures for the completion of a general Indian Atlas in this country.

We therefore direct in the most positive manner that all original maps and surveys be transmitted here with the least practicable delay[7].

To Bengal they confirmed

that the Indian Atlas should be compiled and engraved in this country. For which purpose

1 DDn. 223 (53), 27–7–27. 2 CD to B., Mil., 28–2–27 (2, 3). 3 DDn. 231 (49), 5–11–27. 4 CD to B., Mil., 30–4–28 (34); DDn. 90 (63). 5 Index engraved, J. & C. Walker, for Horseburgh, 1–2–27; Markham (406, 433–8); MRIO. 95 (14), 135 (36); *IO Cat.* (81–3). 6 sheets numbered VII-2-SW., etc. 7 CD to M., 16–6–28 (65–70); DDn. 217 (231).

we have, in preceding letters, directed that all parts of India not previously surveyed should now be surveyed...in a scientific and satisfactory manner, upon an uniform scale of four miles to an inch [296], and that the original surveys and field books should be transmitted to us, copies...being carefully preserved in India. ...

We forward to you an index map in which the sheets...which have been already engraved, or of which we are in possession of the necessary materials of compilation, are coloured red. ... We have transmitted to you copies of such parts of the Atlas as have been published, and we shall continue to supply you with other parts...as the work proceeds.

The Surveyor General will observe that the curves of latitude and longitude are so projected that they will, when completed, coincide correctly and form one map; and it will be his duty...to examine...each survey transmitted to us, sanctioning such as are correct by his authority, and correcting...such as may be erroneous[1].

In 1829 the progress of the Atlas was reviewed in Calcutta;

This noble work, of itself a splendid monument of the munificence of the East India Company is upon a scale of 4 miles to an inch, and taken from actual surveys which when completed will form a Map of India on one uniform plan. The project was first conceived by Colonel Mackenzie [283], and a large portion of those parts already published were surveyed under his superintendence. ... The sheets are published as they are completed; some of them have blank spaces to be filled up as the surveys proceed, nothing being allowed to go forth to the world which is not founded upon actual survey.

Sheet 47 contains the surveys of Capt. Hodgson & Lieut. Herbert in north part of Sirmur, and principal part of Bissahir.

Sheet 48, Hodgson & Herbert, in south part of Sirmur, part of Garhwal & Dehra Dun. Flat country from surveys of White, Hodgson, Colvin, and Blake.

Sheet 65, Hodgson & Herbert; source of Ganges, Hearsey & Moorcroft, sources of Indus & Ganges. Sheet 66, Webb, Kumaun.

Sheets 69 & 70, Bundelkund by Franklin, brother to Sir John Franklin, R.N.

Sheets 42, 43, 58, 60, 77, 78, 80, 81, 95, are surveys executed in the Peninsula[2].

John Walker, the engraver, "combined the various documents sent home, ... prepared the sheets for publication, engraved them on copper, and issued them". He worked under Horsburgh until the latter's death in 1838, when he "was then engaged to take charge of all the records"[3].

[1]CD to B., Mil., 9–9–29 (3–6). [2]*Gleanings in Science*, Nov. 1829 (347) quoted from *As J.* [3]Markham (406, 438).

CHAPTER XX

MAPS—(*Continued*)

Maps published in England — Record & Issue — India House — Projections & Scales — Orthography — Engraving & Lithography.

THE more important general maps of this period were compiled and published from material lent from India House, first by the celebrated cartographer Aaron Arrowsmith[1] [II, 285 n.8], and after his death in 1823 by the firm of Kingsbury, Parbury and Allen.

Arrowsmith's first map of India had been published in 1804, in six sheets, on scale about 2½ inches to a degree [II, 285–7]. In 1816 he issued a new map, in eight sheets, scale 16 miles to an inch, with an index which bears this note ;

For the great addition and improvement in this republication of the Map of India, I have to express my grateful thanks...to His Grace the Duke of Wellington for valuable materials collected during his campaign in India ; to Colonel Allan ; General Kyd ; Sir John Malcolm ; Sir James Mackintosh[2] ; Dr. Buchanan ; Mr. Sydenham ; but chiefly to the Hon. Court of Directors for their liberally permitting me the use of the truly valuable Map of Mysore by Colonel Colin Mackenzie, Surveyor General of India[3].

The map was an excellent production, though it naturally came in for much criticism from surveyors who were familiar with the country and more recent surveys. Lambton was particularly severe ;

It is mortifying to see so beautiful a map...replete with errors. The outline of the Peninsula has evidently been taken from some bad copy of my plan of positions, but, on comparing the places in general in the interior, there is scarcely one that is not out 2, 3, & 4 minutes of latitude. Unpardonable errors where a country has been actually surveyed, and where the position of every place of note has been fixed by me to within one or two seconds of the truth. Luckily my name has been kept out of sight[4].

In 1821 Hodgson compared it against the revised copy of Reynolds' map before reporting that the latter was not worth publication [II, 67 n.1, 285 ; III 280] ;

Arrowsmith's eight-sheet map...contains more places than are laid down in the Bombay map, and...with equal accuracy. ... I do not perceive any additions to General Reynolds' original map which are not in Arrowsmith's, and the latter contains several which are wanting in the former. ... Arrowsmith, ... as he had access to the geographical materials in the India House, ... availed himself of it with much success. It is fair to suppose that he copied what he chose out of General Reynolds' map[5], as well as from...more recent surveys, ... and, ... considering Arrowsmith had the best materials extant in England in 1815, and as his map...contains... more places than that of General Reynolds' does, though double the size, and is of recent construction, ... it is more valuable than the large map of 1808 [II, pl. 3][6].

The map of Arrowsmith, though...far from correct, and exhibiting great blanks, I... consider as the best hitherto published, but in its turn its value will soon be much diminished by that which I am preparing on the same scale from later and better materials, of which there is a great accumulation in this office not yet digested or reduced to one scale [274, 281].

It was easy to point out in 1821 many areas where surveys had been too recent for inclusion in a map of 1815, but it must have given Hodgson a special delight to note that, "with regard to the northern mountains and former possessions of the Nepalese, more places are laid down in Arrowsmith's than in Reynolds' map, but there is nothing of the least value in either" [29–48][7].

[1] (1750–1823) ; Hydrographer to the Prince of Wales, 1804 ; 24 Rathbone Place & 10 Soho Sq., London ; *DNB*. [2] (1765–1832) ; Recorder of Bombay, 1804–11 ; Board of Control, 1830. *DNB*. [3] IO Maps, II AC. (38) ; *IO Cat.* (85). [4] to Resdt. Hyderābād, 21–5–18 ; DDn. 92 (43). [5] the original, taken home by Reynolds in 1807 [II 283–4]. [6] the copy sent to Calcutta in 1809. [7] DDn. 196 (90), 18–9–21.

Arrowsmith took his detail for Bihār and Bengal mostly from Rennell, and it is not surprising that the Plantation Committee of 1823 found it inadequate for their purposes, though their complaints brought Hodgson forward in defence ;

The very valuable map...is consulted with advantage by all the departments. ... It is the result of the labours of our most distinguished Geographers for half a century past, and was constructed...from the authentic documents transmitted from India. ...

Since the lower and middle provinces have ceased to be the seat of war, surveys have not been continued in then, and the maps of Rennell, Colebrooke, and other surveyors, which are incorporated into Arrowsmith's map, are our only authorities, and hitherto unimpeached. Nevertheless, such proofs as the Plantation Committee may offer in support of the alleged inaccuracy of the most recent map published will be duly attended to.

It is true that in the very remote provinces which our armies have lately traversed, even the excellent map of Arrowsmith is...deficient in geographical precision, but, as most places of note are to be found in it, ... some differences in...true positions may not render it unworthy of the...use of the Plantation Committee, for to attempt to reconstruct the...maps of the...Bengal Presidency for its special use would be a labour of incredible magnitude. ... Arrowsmith's map published in 1821 is more full than that of 1815, and may be purchased here[1].

This map of 1821 was advertised in 1820 as "Arrowsmith's new Map of India, with additions to 1819, to fold in a case ; price Rs. 130 (ready money)"[2].

Six copies of the 1815 map was sent out to each presidency [285]. Bengal was honoured by an extra four, with the request that one copy should be returned with amendments, a task that the Surveyor General put on one side regardless of frequent reminders[3]. Hodgson writes shortly after taking office ;

I have found...a letter...dated 13th January last, to which...Colonel Mackenzie who was then in infirm health, was unable to reply. ... To correct...Arrowsmith's large map of India which, extending from the 67th to nearly the 93rd degree of east longitude, and from the 8th to 31st degree of north latitude, comprehends a very considerable portion of the map of the Globe, ... is...as desirable as its execution is laborious and difficult[4].

Instructions were passed out to all surveyors to send in reductions of their field work both on the ¼-inch and 16-mile scales, and Hodgson told Government that he was preparing the 16-mile map, as ordered in 1820,

for the corrections of the general geography of India, for which purpose I am reforming the maps of the Peninsula on the fundamental and perfectly correct basis of Colonel Lambton's trigonometrical operations, and also of that vast tract from the Nerbuddah...to...the confines of Chinese Tartary in the 32nd degree of north latitude, regions in which very great additions have been made to geography since our armies have traversed or occupied them[5].

In 1822 Arrowsmith issued a map of the southern peninsula on the quarter-inch scale[6], of which Markham writes ;

The labours of the...Madras Military Institute...began to attract attention as soon as their results arrived in England, and the necessity for...more accurate and detailed maps...was soon acknowledged. Aaron Arrowsmith...constructed a projection for a new atlas of India on the scale of four miles to an inch [293], and the Madras survey maps were placed in his hands. The result was the publication of his atlas of South India, from Cape Comorin to the Krishna in 18 sheets, ... which appeared in July 1822[7].

This was a great advance on any previous publication, but was very sketchy in areas such as Guntūr and Ongole, which were yet to be covered by regular surveys, whilst Travancore was left entirely blank. The 18 sheets included an index, and an inset shewing Arrowsmith's projected rectangular lay-out of ¼-inch sheets, numbered from 1 in the south to 102 in the Himālaya. We find a bill from W. Thacker & Co. [214 n.4], Calcutta 1827, for supplying—Arrowsmith's Atlas of South India—Elephant Folio—½-bound in Russia—Two copies @Rs. 200—Packing in wax-cloth, tin, etc. Rs. 6[8]. In deference to the Directors' favourable reference to this map as a basis for their new Atlas of India [283], Blacker abstained "from the invidious task" of pointing out its defects[9].

In 1818 Arrowsmith issued a Map of Asia, followed by a revised edition in 1822, on which the German geographer Klaproth [57 n.4], wrote a spiteful review ;

[1] DDn. 198 (129–30), 24–10–23. [2] *Govt. Gaz.* 22–6–20. [3] CD to B., 12–6–16 (16) ; 28–6–20 (79) ; 13–10–24. [4] DDn. 196 (25), 11–6–21. [5] ib. (90), 18–9–21. [6] copy in Connemara Lib., Madras ; also IO Maps. I. AC. 17 ; *IO Cat.* (86) ; cf *As R.* XVI pl. 1. [7] Markham (405). [8] DDn. 220 (223). [9] DDn. 204 (87), 11–8–24.

Arrowsmith, the most ignorant of all those who are employed in constructing maps, has borrowed a map of Japan by M. Abel Remusat[1] and has copied it just as it was into his Map of Asia, in four large sheets, finished in 1818, and revised in 1822, Hence these Islands [Japanese] appear three times larger than they really are. ... It is much to be desired that the few persons who make geography a scientific study, and whô are capable of judging of the horrible productions daily offered to us under the denomination of maps, would give themselves the trouble to examine and criticise them severely.

Hé concludes by stating that many published maps "possess no other merit besides the beauty of the engraving"[2].

Amongst other maps issued by Arrowsmith were those which accompanied Blacker's *Memoir of...the Mahratta War*, published in 1821[3] [282], and Malcolm's *Map of Central India, including Malwa* [84].

In 1824, after Arrowsmith's death, a full map of India was published by Cary, in six sheets, largely from Blacker's material, scale 25 miles to an inch, followed by a reduction in two sheets[4] ;

A New Map of Hindostan...from original materials, exhibiting its political divisions & the natural features of the country. ...—To Lt Colonel Valentine Blacker, C.B., Surveyor General of India, this map is most respectfully Dedicated, in gratitude for the very liberal assistance afforded by him in the communication of many valuable materials from which it has been principally contructed.—G. & J. Cary, London, 86 St. James's Street, July 1st 1824[5].

An interesting extension was printed with Cary's six-sheet map of 1824, entitled *Map of the Countries between India and Europe*, scale 120 miles to an inch, that gives a detailed table of overland journeys between India and Europe —

Carsten Niebuhr [I, 120], 1761–3 — Eyles Irwin [I, 341], 1777, 1780–1 — George Forster [I, 337], 1783 — Captain Campbell, 1792 — Captain Jackson, 1797 — James Morier [II, 444–5], 1808–9 — Major Kinneir [John Macdonald, II, 418–9], 1814 — John Johnson [II, 409–10], 1817 — Lieut. Heude (*sic*), 1817 — George Fitzclarence[6], 1818.

Fitzclarence had been A.D.C. to Marquess Hastings during the Marātha War, and was sent home overland with news of peace. His account of the journey, with maps, was published in 1819.

Another map issued about this time was one by Kingsbury, Parbury, & Allen, in four sheets scale 32 miles to an inch, that was advertised in Calcutta[7] ;

Just landed & for sale—A newly constructed and extended map of India—From the latest surveys of the best authorities, published principally for the use of the officers of the army, and inscribed to Maj. General Sir John Malcolm. Price in portable case, on rollers, 40 rupees ; varnished 45 rupees. Wm. Thacker & Co.

The same firm also published the map issued as frontispiece to Prinsep's *Narrative of...British India under the Marquis of Hastings*, 1813–18, entitled *Map of the Seat of the War in India 1817–8*, scale two inches to a degree, "compiled and drawn for the use of the Commander-in-Chief's office, Fort William, Bengal. ... 1st June 1825". The map gives routes of various columns which operated against the *pindāris* and Marāthas. They also published a *Map of the Western Provinces of Hindoostan*, in four sheets, inscribed to Malcolm, together with an

index, containing the Names and Geographical Positions of all places in the maps of India, especially that newly constructed and extended *Map of India*[8], lately published by Kingsbury, Parbury & Allen, Booksellers to Hon. East India Company, ... London 1826.

RECORD & ISSUE

In their instructions for the establishment of a Surveyor General of India, the Directors made him responsible for maintaining a depot of maps at Fort William,

[1] Jean Pierre Abel Remusat (1788–1832) ; French scholar of Chinese ; Editor of *Journal des Savants* from 1818 ; *Ency. Brit.* [2] *As J.* 1826 (65) ; quoting from *Journal Asiatique*, of Paris ; reproduced in original French ; *IO Tract.* 461. [3] engraved by Sidney Hall "under the inspection of Mr. Arrowsmith". [4] *IO Cat.* (86) ; MRIO. 97 B (1–3). IO II AC. 13. [5] John Cary was a noted engraver and publisher of maps between 1787 and 1820 ; his firm G. & S. Cary continued to publish in London up to 1844. [6] Lt Col. Geo Aug. Fredk. Fitzclarence (1794–1842) ; cr. 1st Earl of Munster, 1831 ; *DNB* ; the 5th Earl of Munster flew to India in 1944 to visit the 14th Army, piloted by David Phillimore, my nephew. [7] *Govt. Gaz.* 15–12–25. [8] *IO Cat.* (86).

and for security and distribution. There was a strict rule that surveyors should treat their work as secret, and not pass copies to local officers, either civil or military, without proper authority [II, 288–9 ; III, 274].

Even when surveying Orissa at the Commissioner's request, Buxton asked for the Surveyor General's permission to issue a copy of his survey ; "My instructions are to show a map to nobody, and...I have refused to do so to the Commissioner, much, however, I rather suspect, to his surprize. I beg...to be set right if I have acted wrong"[1]. The Surveyor General approved, and referred to a recent Government order that local officers issued with maps

will...preserve them in their offices, and transfer them to their successors, ... and not...permit any additions to be inserted in them. But...the prohibition against allowing copies or extracts should be qualified by sanctioning the practice in cases where it may be found necessary for the public service, a report then being made to your office[2].

On his arrival from Madras Mackenzie found that these regulations were too often disregarded, but before taking action he consulted Garstin and Thomas Wood. He writes later to Webb disapproving of Tate's correspondence with civil officers ;

It is not approved that a person employed on public duty should communicate on the subject of his official duties to any person whatever without permission. ... I may go thro' the disagreeable ordeal of declining propositions, & be reckoned a crusty disobliging old fellow for my pains, while meantime an order may be obtained before you can help it.

He asked Webb to pass no part of his survey to others until the whole was completed and officially submitted to the Surveyor General[3].

In spite of all precautions, it was found in 1820 that many maps were scattered through the various Government offices in Calcutta, mostly unknown to the Surveyor General. Franklin was deputed to examine them [337] ;

A considerable mass of geographical information has...been collected in...public departments which, from want of due arrangement, ... may in time be dispersed altogether beyond the reach of Goverment. ... The Most Noble the Governor General is in possession of several important... sketches...from various officers on active service. Many are also in the office of His Lordship's Military Secretary. ... There are likewise a few maps in the...Political Department.

You will examine, arrange, and collate the...documents...in such a form as to render them accessible, ... and...construct descriptive catalogues, ... and...report your opinion with regard to...[distribution between] the office of the Surveyor General, or the Quarter Master General.

Franklin found material not yet incorporated in the Surveyor General's maps[4] ;

I was able to collate the whole...and arrange it into uniform and complete district maps, ... and, this appearing to me to be the most useful shape in which I could condense the variety of information, ... I commenced on Bundelcund, as well because it is centrically situated, as because I had full and authentic materials for the work [81–2].

As I proceed in my labours, I register in a catalogue the various documents I make use of[5]. I have already commenced a map of the States west of the Jumna River, because the information we possess regarding them is extensive. ... It consists of actual surveys and...routes which, when arranged and consolidated, will...produce a map greatly superior to any which we ...possess of that part of the country. Meantime I am making endeavours to procure efficient information for...filling up the more interesting blanks of Jubbulpore and Central India. ...

I have commenced a General Military Map on a smaller scale, on which I have already completed a skeleton series of points from the Sutlej River through Central India to the Dekhan, and have connected in the most satisfactory manner all the labours of the Madras Quarter Master General's Department with those of Bengal[6].

He was told to confine himself to listing the maps into suitable groups ;

It was not contemplated that you should engraft the information so obtained on former materials, or...frame compilations which would greatly protract the period of your present employment, and which could more regularly and more expeditiously be executed under the direction of the Surveyor General[7].

He completed the work in another six months, compiling two new maps which he submitted with a descriptive catalogue, reporting that it had been his

chief care to avoid copying documents which already existed in the public offices. ... The maps

[1] DDn. 147 (267), 4-6-20. [2] ib. 144 (327), 24-9-19. [3] DDn. 156 (152-4); 26-3-19. [4] DDn. 191 (55), 7-7-20. [5] ib. (58-63), 9-11-20. [6] ib. (55), 7-7-20. [7] ib. (63-5), 26-1-21.

which are herewith submitted are new, and have, by means of my present employment, been preserved to the public service. After the completion of these two maps, the remaining documents...will consist of various plans of forts not at present in the office of the Chief Engineer, and several plans of battles and other topographical sketches relating to the late campaign, ... and also a very extensive collection...made by the late Lieutenant Pickersgill, and intended by him for a work which he contemplated on the Nepaulese war [II, 437]. ...

The present documents appear to me more adapted for deposit in [the office] of the Surveyor General, ... as the Quarter Master General can have access to them at any time [302, 334]. ... I have several maps, the private property of the late Colonel Fagan[1], which...I solicit permission to deposit...also in the office of the Surveyor General with a separate catalogue[2].

His proposals were all approved.

Though Blacker had obtained permission to use official maps for the illustration of his *Memoir* of the Marātha war, it was suggested that he had exceeded his permit in passing any to Cary for private publication [289]. It is hardly likely that the Directors would have appointed him Surveyor General if this were true, for it was a practice that had caused them much concern ever since the old days of Clive and Vansittart [I, 256 : II, 287]. Hodgson broached the subject to Jopp in 1826 ;

The improper liberty which has within late years too often been taken by public officers and Heads of Departments, of carrying away with them to England papers in their charge, and especially maps, must be brought to the notice of Government, here and at home. I know that very sinister uses have been made of such maps, but I trust a speedy report made to England will prevent the abuse in future. I...desire you to prepare lists of all the maps you have, and to make particular mention of any...which are missing. These circumstances should be fully explained to your own Government, and reported to me[3].

The matter drew further comment from the Directors in 1828 ;

Some of our officers who have been employed in the Surveying Department have sent copies of their surveys to Europe for publication on private behalf ; ... you will...prohibit such practice in future. All surveys made at the public expence are public property, and we direct that no copies of any surveys, so made, be delivered to any persons except these appointed by Government to receive them[4].

Circulars were thereupon sent round to all surveyors ruling that,

in the event of your quitting the Survey Department, a declaration on honour will be required, specifying that you have not retained or delivered to any individual, or sent to your friends in England, any maps or papers whatever connected with the surveys on which you may have been employed at the expense of the Government [II, 288–9][5].

On this Montgomerie commented :

I think it is a pity the Court of Directors did not name the officers who sent copies of their surveys for publication on private account. Have you any idea who they were ? Colonel Blacker, I think, was the only person in this Presidency who availed himself of his situation when Quarter Master General to take copies of surveys [86][6].

It had been directed that custody of survey records at Madras and Bombay should be entrusted to the Chief Engineer [303], but Mackenzie had little difficulty in demonstrating the absurdity of such an arrangement [315–6]. Before he left Madras he overhauled the records there, finding a total of 2,986 items, which he left under charge of Riddell [316], to whom he writes from Calcutta ;

I have just got thro' the inspection of the contents of the depot ; there are only about 750 titles, scarcely 1/3rd of the Madras depot. These consist almost entirely of itinerary surveys, corrected sometimes by astronomical observations ; no statistic surveys. Only 2 or 3 general compilations ; but one of them very extensive, but old, & nearly obsolete[7]. On the whole the depot is inferior to the Madras one.

I have not yet...examined the records, but...they consist chiefly of field books, &...there are no...memoirs. The regulations, reports, & office hours, differ much from ours, & I have hitherto declined bringing my Madras people in contact with them, till I get into a large house, capable of one regulating system [310][8].

Both Mountford and Montgomerie had a continual struggle to keep pace with

[1]late AG. [II, 41]. [2]DDn. 191 (351–5), 16–8–21. [3]DDn. 223 (38), 8–8–26. [4]CD to B., Mil., 16–1–28 (12, 13) ; DDn. 90 (55) & 217 (159). [5]DDn. 184 (473), 23–6–28 ; cf. 217 (159) of 6–6–28 & 220 (337), 11–6–28. [6]DDn. 231 (201), 13–11–28. [7]probably Thos. Call's atlas (I, 215–7) ; MRIO. 95 (32–53). [8]DDn. 156 (291), 18–8–17.

the demand for copies and reductions of maps, which had all to be made by hand. Mountford repeatedly asked for regular accounts of maps issued and that,

on a map being furnished, ... a receipt...be deposited in this office and that, with a view to the further safety of such maps...(the preparation of which has been attended with so heavy an expence), periodical returns be made. ... I...hope that maps will be better preserved ; ... and that, while every latitude is given to the circulation of geographical information, ... due attention to the spirit of the...orders relative to the multiplication of map will be granted[1].

The Surveyor General did all he could to persuade officers to use maps published in England, rather than call on the survey office for hand-drawn copies [276–7 Regarding materials for the ¼-inch Atlas, Hodgson asked Montgomerie to

be particularly careful that all the work...be done...under your immediate inspection, and that nothing...is made public by private lithographists[2]. Each sheet when finished should be kept by you, locked up and under your seal[3]. ...

There can be no reason why labour, which might be otherwise so much better employed, and which is...so urgently required for the fulfilment of...the positive commands of the Supreme Government, should be lost in making for the Commander-in-Chief copies of maps which his Quarter Master General has. What could he do with them[4] ?

As copies of the new Atlas began to reach India, the Directors became more than ever opposed to the distribution of hand-drawn copies ;

With our despatch of the 28th January 1829, copies...were sent to you, and we anticipate a great saving of labour in the Deputy Surveyor General's Office. ...

We...draw your attention to the frequent, and we believe often unnecessary, calls for maps by our officers, civil and military, caused by the neglectful custody, or irregular appropriation, of those documents ; and we desire that it may be intimated to all our servants that maps supplied from our public offices are public property, to be carefully kept[5].

At Bombay the custody of maps rested with Williams till his retirement, and then passed to Sutherland, first as Assistant, and then as Deputy, Surveyor General [323]. To give the Surveyor General closer control, Blacker had the following orders issued by the Supreme Government ;

All original surveys, with whatever original documents may be attached to them, now at either of the subordinate Presidencies, are to be transferred to the Geographical Depot in Bengal, the Deputy Surveyor General retaining copies of such as may be thought necessary. This last measure, ... prescribed by the 22nd paragraph of the Hon'ble Court's letter of the 3rd June 1814, became necessary in consequence of the late instructions for the preparation of a General Atlas on a large scale from original materials ; but...the...times in which he may require to call for them are left to the Surveyor General. ...

No survey shall be admitted by the Surveyor General as complete, unless accompanied with a document explanatory of its authority and construction[6] [194].

INDIA HOUSE

The established procedure under which copies of field books and surveys were regularly despatched to the Court of Directors was confirmed in 1814 [II, 287], but the Directors had to send constant reminders, and call for regular lists from each Presidency. During 1821–2, Claude Wade, Assistant Surveyor General at Calcutta, was employed for several months "examining the copies of journals and field books ...for the Court of Directors". For several years, however, nothing was sent from Bombay except copies of the revenue surveys [281].

For the preparation of the Atlas of India in London, strict accuracy became imperative, and in 1827 the Directors noted that "several of the surveys...sent to us from your Presidency are very incorrectly copied" [313–4], and ordered that originals should be sent home, and copies retained in India [285–6][7].

Before handing over duty as Surveyor General, Hodgson sent in a complete list of the materials that had been sent home, and of what remained in India ;

[1] DDn. 192 (315), 5–11–21. [2] Lithography introduced in Calcutta and Madras about 1822 [298–9]. [3] DDn. 184 (421), 30–11–26. [4] DDn. 223 (44), 8–2–27. [5] CD to B., Mil., 15–4–29 ; DDn. 263 (131). [6] BGO. 6–1–25 (6). [7] CD to B., Mil., 2–5–27 (4), DDn. 90 (49).

Regarding the construction of a map of India at home, ... and...the transmission of all original field books and other documents, ... every attention has been paid to...orders. ... I have compiled two very full lists, sent herewith, ... the one of maps and plans, the other of field books and other written documents ; ... The...arrangement of this extensive catalogue ...has been a work of great labour, and has employed several of the most effective people of the office for many months past. If ever the task of constructing a map of India in England be executed, it will be mainly owing to the assistance which this catalogue will afford[1].

A year later Herbert despatched a further consignment,

packed in five tin cases, secured with brass locks, which are covered with wax-cloth, and sealed with the seal of the office. These documents are...all original, and...it was necessary to have a correct copy of each document before the original could be spared from the office. ...

Nothing but the very peremptory nature of the Court's order could have induced me to send materials which are so likely to occasion...disappointment in any attempt to turn them to use in England. ... To follow my own judgement, I would have substituted for them such sheets of the Great Atlas...as might have been constructed with tolerable correctness. ...

That such a task can be better performed here than in England...I cannot but believe. ... In comparing discordant materials it would be a great help to the map compiler to be... acquainted with the...acquirements of the surveyor, with the instruments used, and the methods followed [285]. ... I should have considered my time more usefully employed in...digesting the heterogeneous material now sent into something like shape and system, than in...copying documents many of which are...not worth the labour. But I could not substitute...my views ...for the repeated and positive orders of the Court [I, 252][2].

PROJECTIONS & SCALES

Most surveyors could lay down the projection of their maps and surveys from authorized tables giving lengths of parallels and meridians. Hutton's tables were generally used [I, 248], until the issue of Lambton's values [II, 215 ; *inf*].

Of his map of Kumaun Webb writes in 1819 ;

The length of a minute of the meridian has been taken at 1810 fathoms, and the projection of the map itself has been made on what is called the Diagonal method, the only mode I am acquainted with by which the relative positions of places can be preserved, as well as their distances from each other upon an equal scale. I imagine the method itself is not new, but it was first pointed out and explained to me by Mr. Arrowsmith[3].

On receipt of the Directors' letter of October 1823 proposing a "complete Indian Atlas" [283], Blacker assumed that he was to prepare it in India [284], following approximately the lay-out shown on Arrowsmith's atlas of the south peninsula [288]. He first consulted Everest ;

The last paper of Col. Lambton...that discusses the figure of the earth as deduced from a comparison of his own measurements with certain others in Europe...is published in the 13th vol. of the Asiatic Researches[4], after he had advanced his meridional arc to 18° 3′ 45″. ... He concludes the earth's ellipticity to be...1/304, and...annexed a table of the value of degrees on the meridian...for every degree of latitude, and on arcs perpendicular to the meridian [II, 260]. In consequence of orders from the Court of Directors, I am about to engage on the projection of a General Atlas...and...I am desirous of ascertaining whether any reason has occurred since the date of the paper in question for doubting the correctness of its conclusions[5].

He then worked out his projection ;

The calculations for the graticulæ have been completed. ... Considering the proposed atlas as a great national work, every part of its construction becomes a matter of importance, and exacts a reference to principles that shall stand the test of scientific investigation. I have therefore bestowed on the determination of the intersections of its great and small circles pains which, I apprehend, are novel...in India. ...

I...forward for transmission to England a copy in duplicate of the tables which have been calculated, and the arguments which have been employed in arriving at the desired results. I have been induced to take some impressions of them in lithography, as well to secure the accuracy of the copies, as to provide a sufficient number for future reference[6] ; for...these

[1] DDn. 231 (236), 4-1-29. [2] DDn. 265 (2), 29-1-30. [3] DDn. 150 (95), 4-3-19. [4] pp. 1-127. [5] DDn. 93 (120), 4-9-24, Everest's reply not found. [6] no copy found ; "a single sheet of large foolscap".

tables will answer for all other maps within the parallels of 8° and 32°, under any other meridian, as likewise for any other scale by...simple proportion. ...

In order that...the proposed atlas may be clearly understood, ... I herewith forward in duplicate a geographical sketch exhibiting its proposed dimensions and subdivision, but extension...will be attended with no difficulty. With regard to the size of each sheet, I have conformed as nearly to the instructions of the Honorable the Court of Directors as was possible, for the size of a sheet of Arrowsmith's atlas, which received their approval, contains 1071·9 square inches, and in the present projection it measures 1056·6 square inches [296][1].

Two years later, Hodgson records the source of Blacker's inspiration ;

This graticule and scheme of calculation is taken from a very good model, that of the great map of France, as...described in the Supplément of Puissant's "Topographie"[2]. ... The meridians converge to the 80th degree of Longitude, and the 20th degree of Latitude is the central parallel. The extent of the map (of which each sheet is a component piece) is from the 8th to the 32nd degree of north latitude, and from the 67th to the 93rd degree of east longitude, and I think the arrangement...as judicious as any that could be proposed.

The Hon'ble Court use the term General Atlas of India. With a view that it may be completed in that sense, ... the component parts should be so arranged that they may compose one perfect whole, in the manner of the great map of France. It is not intended, nor expected, nor could it be of any use, that the sheets should be actually laid together on so large a scale of four miles to an inch, yet still it is in accordance with the best models that the meridians should converge to some centre, ... and, what is of most consequence, it is necessary that the differences of longitudes in so vast an extent as 26 degrees (nay more, when we include our new discoveries to the borders of Yunan in China) should be well adjusted among themselves[3].

He explained to Montgomerie that he

was almost tempted to make it on a smaller page, i.e., to a degree and a half in latitude and two degrees in longitude, making each converge to the center of the sheet. My original plan of only one degree of latitude was too small, and Colonel B's is rather too large, but in case of further reduction to 8 miles, it will be convenient. It certainly is not of consequence to make the meridians converge to the centre of so great a map as all these sheets laid together would compose, because such a map would be useless ; however, it is the fashion to make them so, and as to the size of the sheets there is much to be said on all sides[4].

With his lithographed tables Blacker had attached instructions for their graphic protraction, accounts of which are given twenty-five years later by Thuillier and the head computer, Radhanath Sikdar. Neither of them makes any reference to Puissant. In his *Manual of Surveying* Thuillier describes

the graticule of maps comprising small portions of the globe for which Colonel Blacker drew up a memorandum of instructions, which is simple and accurate within certain limits, about 100 square degrees. The objections to the method are that it is an empirical process based on no known projection, and the protraction has a tendency to generate error because it is not laid off from one common origin. The spaces are built one on the other, whereby the error in any point is carried on through all the succeeding ones[5].

Radhanath Sickdhar writes in the departmental *Auxiliary Tables* of 1851 ;

The tables for map projection, and the manner in which they have been computed and arranged, will be found well explained in the...memorandum drawn out by the late Colonel Blacker for the use of the draughtsmen in the Surveyor General's Office. By a mechanical operation...is produced a graticule whose meridians are all equal, are equidistant at all corresponding points, are intersected by the parallels at equal angles on the same side, and whose parallels consist of parts proportional to the cosines of their latitudes[6].

Following the clue given by Hodgson, we find that the library at Dehra Dūn still holds the identical copy of Puissant's *Traité de Topographie, d'Arpentage, et de Nivellement*, that was consulted by Blacker. It bears a note in Hodgson's handwriting, "Surveyor General's Office. Purchased 2 May 1822[7], Rs. 12. J.A.H.". It is freely annotated in pencil, more particularly the paragraphs which deal with the modified Flamsteed projection[8], adopted by Colonel Henry, "Colonel au Corps Impérial des Ingénieurs-Géographes", for the great military map of France.

[1] fitting double-elephant drawing paper [296]; DDn. 204 (170), 12-7-25. [2] Colonel Louis Puissant (1769–1843) ; Corps des Ingénieurs-Géographes ; *Service Géographique* (20, 28, pl. 30). [3] DDn. 231 (49), 5-11-27. [4] DDn. 223 (53), 27-7-27. [5] Thuillier & Smyth (552). [6] *Aux. Tables*, 1st edn. ; 1851. [7] possibly from Grant [183]. [8] Rev. John Flamsteed (1646–1719) ; first AR., 1875 ; FRS. 1677. *DNB.*

Puissant's *Supplèment* which deals with the subject of map projections is dated Paris, 1810, and describes

la projection que le Depot général de la Guerre a adoptée pour la réunion des levés topographiques. Cette projection connue sous le nom de "projection modifiée de Flamstéed", ou de "projection conique alterée", a obtenu dans cet établissement la préférence sur toutes les autres[1].

The projection was specially designed for maps comprising a number of sheets covering a wide area, and its particular properties were ;

1re. Sur le méridien rectiligne de la carte et les parallèles, les longeurs sont les mêmes que le globe terrestre.

2me. Tous les meridiens coupent à angles droits le parallèle moyen.

3me. Les petits arcs de méridien ayant même amplitude, sont sensiblement égaux entre eux, au voisinage de ce parallèle, ou du méridien moyen.

La présente projection s'identifie absolument avec celle de Flamstéed proprement dite, lorsque l'on prend l'équateur même pour parallèle moyen ; auquel cas les méridiens et les autres paralléles sont placés symetriquement de part et d'autre du centre du développement[2].

In the official history of the Service Géographique this projection is described as devised by the elder Bonne[3] about 1750 ;

Le système de projection, adopté (Flamstéed-Bonne) consiste dans la projection de la surface à representer sur un cone tangent à la terre le long d'un parallèle choisi.

Cette projection a l'avantage d'etre "équivalente", c'est à dire de conserver leur vraie valeur aux surfaces ; elle n'est pas équiangle, mais n'altère que peu les angles et les longeurs, jusqu'à une assez grande distance des méridien et parallèle origines[4].

Colonel Henry adopted this modified projection to the needs of the French military map, and worked out the necessary formulæ and tables ;

M. Henry, astronome du Depot général de la Geurre, doit publier dans le Mémorial de cet établissement un Memoire sur les proprietés et l'usage de la projection actuelle. Outre les formules précedentés qu'il a obtenues de son coté, et reduites en tables, il est parvenu, par un analyse élégante, à d'autre formules non moins utiles[5].

The *Supplèment* gives Henry's formulæ, and it is obvious that Blacker, whose attention had probably been drawn to Puissant's description by Hodgson, applied it to the continent of India, and worked out his tables for protracting the graticule of his new quarter-inch atlas, using Lambton's constants [II, 262 ; III, 253–4][6]. It has been suggested that Blacker must have been a great mathematician to have devised this projection, but he was not so[7]. He was essentially a keen practical man, of high intelligence and forceful character, and an excellent organizer and administrator. Henry and Puissant were the mathematicians.

Though Blacker's projection was later adopted for departmental standard maps prepared in India, his tables had been despatched from Calcutta after the first sheets of the Atlas had been prepared in London on Arrowsmith's globular projection[8] [283, 285]. John Walker appears then to have adopted them for his later sheets with considerable modification, without leaving any clear record. After his death in 1873, General Walker discusses at length the projection actually used and describes it as

one of the numerous modifications of the conical development ; it represents the parallels of latitude by concentric arcs, but the meridians by arcs concave to the central meridian, and not by straight lines as in the true conical development.

The elements of the figure of the earth which are here employed are not stated, but there can be no doubt that they must have been those which were determined by Colonel Lambton from his measurements on the great Indian Arc, and are given in vol. XIII of the "Asiatic Researches" [II, 262 ; III, 293]. ... The accordance is sufficiently close to leave no doubt. ...

The meridian which has been adopted as the central meridian or axis...is 76° 30′ east of Greenwich ; this is not only stated in Mr. Walker's memorandum book, but can be deduced from the calculations. ... What parallel was adopted as the central parallel of the projection is nowhere stated. The sheets of the Atlas are rectangular, their dimensions as taken between the marginal lines on the copper plates being 38 by 27·4 inches[9]. ...

[1] Puissant ; *Supplèment* (iii–iv). [2] ib. (49). [3] Ingénieur-Hydrographe. [4] *Service Géographique* (39–40). [5] Henry's *Memoir* first pubd. 1810 ; *Memorial du Depot de la Guerre* II 7 ; 2nd edn. 1831 pp. 430–587 ; Puissant (146). [6] Cheape or Vincent Rees [309, 313] may have helped. [7] *v.* Sandes, II (193). [8] Markham (406). [9] similar to those of Arrowsmith's index of 1822 [288].

None of the documents to which I have hitherto had access give any information as to who was the originator of the projection of the Indian Atlas. There is a lithographed pamphlet in this office, which is believed to have been written by Col. Blacker, who was Surveyor General of India, but it does not give either the name of the author, or the date at which it was written. It proposes a method of projection which in principle is identical with the one actually adopted, and is based on the same geodetic elements, but differs in all other details, the central parallel—the adopted value of which influences the whole of the calculations —being 20° instead of 24½°, and the central meridian being that of 80° instead of 76½° [295]. The size of the sheets was intended to be 38·38 by 27·53 inches[1]; the origin of co-ordinates was placed in the centre of the atlas, at the point corresponding to lat. 20°, long. 80°, the intersection of the central parallel with the central meridian. ...

All the calculations seem to have been carefully made out and verified, and the results are tabulated in a convenient form for use, which is very far from being the case with the calculations for the actual projection. The design of the atlas is believed to have been influenced to some extent by Mr. Aaron Arrowsmith's Atlas of Southern India, which was evidently designed by its author as the commencement of an Atlas of all India. ... In both atlases the dimentions of the sheets appear to have been regulated by the size of the double elephant sheet of drawing paper[2].

In 1869 the preparation of the Atlas sheets was transferred to India, and a new projection introduced, which lacked the advantages of Blacker's polyconic,

which makes the standard one-inch sheets assume the form of a spheroidal surface when many of them are joined together [and writes Burrard] is so superior to our Atlas sheet projection, which makes all the sheets lie on a horizontal plane, ... that I [Burrard] have in my silent mind given Blacker a very high place in comparative history[3].

General Walker does not discuss the selection of the quarter-inch scale [283, 286], but points out a minute error by which

the dimensions of the copper plate, which should have been 38·31 by 24·65 inches within the border lines, are only 38·00 by 27·45 inches. The error necessitates a reduction of scale of all geographical materials which are drawn on the quarter-inch scale before they can be correctly inserted on the copper plates, but otherwise it is of little importance; in the printed sheets...larger errors arise from the shrinkage of the paper[4].

Regarding scales generally, Mackenzie writes to Webb ;

The scales I recommend for all geographical maps are 1 mile, 2 miles, 4 miles, 8 miles, 12 miles [I, 247–8 ; III, 281–2] ; accordingly, by this established rule, an uniform method is introduced throughout. The first protraction generally one mile to an inch—at least two—in order to admit all villages. The Military Institution used for the first protraction 4 inches to a mile, a good one certainly for a town, but too unwieldy for a country[5].

Mountford writes more fully ;

As far as the purposes of general geography...are concerned, I consider...the scale of 4 British miles to an inch sufficiently large. There are, however, some districts...presenting such a variety of features as to render it very difficult to delineate clearly their character upon so small a scale. ... I would instance the province of Travancore, the maps of which, upon a scale of one mile to an inch, I shall...shortly transmit to you. The map of the circar of Guntoor has lately been reduced to the scale of 4 miles to an inch, but...only a few of the principal names are written upon it, the others being referred to the margin...by bearing and distance from the capital to which they belong [II, 213]. ...

Our surveys...claim something more than what is expected from a Geographical and Military Map, and the demands of Government for copies of maps upon large scales for the several branches of the service (particularly the Revenue and Tank departments) appears to intimate that something more is expected of them [277–8].

The survey of a considerable part of the Carnatic below the Ghauts was executed upon a scale of 4 inches to mile, which, though unnecessarily large, had the good effect of introducing a number of officers well skilled in the delineation of the features of the country. The districts ceded by the Nizam in 1800 were surveyed on a scale of 2 miles to an inch ; but the whole of Mysore and all the districts surveyed under this office were done upon a scale of 1 miles to an inch, which...is the best calculated to prevent any practical error of importance[6].

[1] contents 1056·6 as given in Blacker's letter of 12–7–25, and larger than Walker's [294]. [2] Markham (431–8) cf. Svy. Com. 1905, I (74/100). [3] as told by Gen. Geo. Strahan, DSG. Trig. 1889–94 ; Burrard to Phillimore, 6–5–1935. [4] ib. (439). [5] DDn. 156 (152–4), 26–3–19. [6] DDn. 192 (180), 9–7–21.

The rival systems of Sir William Jones and Dr. Gilchrist for the transliteration of Indian names have been described elsewhere [I, 249–50]. The subject was not one that interested all surveyors, but Gerard of Bengal, and Mountford of Madras were amongst those who took trouble over the spelling of their place-names. Gerard writes of his map of the Dūn [pl. 3] ;

The names of places in this map, as well as in that of the northern division of the Saharanpoor District are written according to Dr. Gilchrist's orthography, with the exception of his final *O* and Arabic *Qaf*. The former I think is often liable to be mistaken for *OO*, and I have accordingly written it short *a*, which is its proper sound.

I have put down the letter *K*, and not *Q* as Dr. Gilchrist has it. The difference between ک and ق being almost imperceptible to Europeans[1].

On the other hand Mounford advocated Sir William Jones' system of orthography"[2]. Being ordered to supply the Board of Revenue with a complete set of district maps [278–9], he asked Government for

lists of all the villages, ... correctly written...in the characters of the language in current use, ... considering the present a favourable opportunity for introducing one general system of orthography into all our maps. ... Hitherto the systems of Sir William Jones and of Dr. Gilchrist have had their respective advocates among the surveyors, while a less definite one has been followed by others. ... The system of Sir William Jones, being universally understood, seems to claim the preference, and if no objection is offered...I shall adopt it[3].

To the Surveyor General he added that he proposed no change to names whose pronunciation was "sanctioned by long established custom. The system of Doctor Gilchrist is not so well understood in this Presidency as it is in Bengal"[4] [II, 271 n.4].

Montgomerie faithfully observed the same rule, and in 1830 found that the correction of the names for his quarter-inch maps entailed a great deal of labour[5]. Holt Mackenzie[6] gave wise advice to his revenue surveyors ;

The use of some fixed principle in expressing native names with English letters seems to me much more important than...generally considered. In the maps of the country I have recently traversed, the names of a multitude of places are so spelt as to make it impossible for a stranger to ascertain what place is meant. It seems to be very desirable that you should [record] the Hindee as well as the English and Persian, and for the rule of conversion into English you should apply to the Record Committee[7].

ENGRAVING & LITHOGRAPHY

There had never been any high-class map-engravers in Calcutta, and the city maps of Baillie and Upjohn [I, 53–4] are amongst the few produced locally. Maps had as a rule to be sent to some private publisher in England, or laboriously copied by hand. Blacker had a good deal to say about the home engravers ;

In various parts of Arrowsmith's Atlas the gradation of shade expressive of hills and mountains bears no analogy to the heights or magnitude of those eminences, and consequently misleads the judgment in a most important point. Yet it cannot be expected that any engraver will be more...sedulous than Mr. Arrowsmith in guarding against this, ... but...it is inseparable from the circumstances under which that individual compiled and published his maps from various materials prepared in different styles and strength of drawing.

Manuscript sections sent home from this country suffer a similar fate, as I know from experience. The indian ink...undergoes a change of strength on the voyage home, and, if made generally darker to provide against the more delicate shades vanishing, an opening is given for miscorrections, as the different shades do not change in the same proportion. ... The engraver is ignorant of what is intended to be expressed, ... notwithstanding his best intentions and endeavours. ... The geographer who prepared the Manuscript is the only individal competent to superintend the engraving of it, as he is the only person who knows the effect required.

[1] DDn. 133 (150), 10–3–18. [2] DDn. 192 (202), 24–7–21. [3] ib. (188), 14–7–21. [4] ib. (190) 14–7–21. [5] DDn. 237 (203), 1–3–30. [6] Sec. to Terr. Rev. Dept. till 1831. [7] to Wm. Brown, Sahāranpur, 17–11–27 ; BTC. 28–6–31 (34).

This truth appears to have been understood in the engraving of the Ordnance Map of England—of Cassini's Map of France—and Ferrari's Map of the Netherlands—as well as other similar works in Germany. Humboldt superintends the engraving of all his own maps, and at that princely Austrian establishment at Milan, "Impt. Reg. Instituto Geografico", which I frequently visited when there, I was assured that as much attention was required on the part of the Head in superintending the engraver who had the fair drafts to work from, as in directing the labours of the draftsmen. ...

Although outlines which are determined by the co-ordinates of latitude and longitude may be transferred with great fidelity to the copper, it is otherwise with the shades expressive of the difference of level, which are therefore very seldom given with accuracy[1].

He suggested that an engraver should be sent out to Calcutta to prepare the Atlas under the control of the Surveyor General, and this was again urged four years later by Hodgson [285], who further suggested that

young men from the schools might be apprenticed...and readily instructed in the business of engraving. ... An Engraver seems as necessary an adjunct in the Surveyor General's Office as does a cutler and repairer of surgical instruments, who was sent from England to...the dispensary, and many artizans have been sent to...the mint, steam, and other establishments[2].

In 1829 Herbert had Wilcox's map of Assam engraved locally [64] ;

Considering the value of this map, and...that more than one copy of it will be required, I would...suggest...that I...have it engraved. One of the native draftsmen in this office is a very tolerable engraver, and...will engage to finish it in four months. To make an ordinary copy would consume two, so that the expence of the engraving will only be (in addition to the price of the copper) the value of his labour for two months. For this we shall have any number of copies desired, and (a point of no small importance) all equally correct.

The price of copper, polishing etc., will be 28 rupees. The impressions will only cost about 8 rupees a hundred. The plate will remain in the office for correction in...any of the doubtful points, or...filling up the blanks[3].

Another of Wilcox's maps was lithographed by J. B. Tassin [299], who had set up an establishment in Calcutta a short while before.

Lithography was yet a new art in England when Hodgson suggested in 1822 that a lithographer should be brought out with suitable apparatus ;

As, in the progress of the Revenue Surveys, the increase of map and plans and the demand for copies...will be considerable, it appears to me expedient to adopt every mode of facilitating their transcription, and...none offers better than the method of printing on stone, called Lithography. If the lithographic presses are really as useful as they are described to be by their inventor—their powers may be advantageously employed in public offices, but particularly in that of the Surveyor General. I...submit...that two lithographic presses...may be commissioned from England for the use of the department, and that the stones and...other apparatus...may be also sent for...two more presses. The larger the stones are, the better, but... if they are made 33 by 23 inches they will answer the requisite purpose. ...

The lithographic presses will occupy a good deal of room on board ship, but as all the woodwork can be made here as perfect as in England, any number of stones, which may hereafter be sent out, ... could be easily mounted in Calcutta when the machine in its complete state has been seen. If...two complete presses...be sent, ... it will be most advisable for the Agents in England to take the advice of Mr. Ackermann[4], who makes the instruments, as to such peculiar structure as he may deem most convenient for copying maps and plans.

No press was procured for the Survey, but by 1823 a Government Lithographic Press had been established in Calcutta[5] [292 n.2], which was available for the printing of maps. Burney's map of Burma was printed there in 1824 [79] ;

The execution of the map has not failed to attract the notice of His Lordship in Council, who considers it to be highly creditable to the Lithographic Press...which on various occasions during the present war has been eminently useful in furnishing numerous impressions of charts and sketches, ... as well as proclamations in the Burmese and Assamese languages, which could not indeed have otherwise been procurable. ...

You will...communicate to Mr. Rind, the superintendent of the Lithographic Press, the very favourable sentiments entertained by Government of the utility of his establishment[6].

[1] DDn. 204 (87), 11-8-24. [2] DDn. 231 (49), 5-11-27. [3] ib. (272), 30-4-30. [4] Rudolph Ackermann (1764-1834) bookseller of Sonneeberg, Bohemia ; established lithography in England, 1817. *DNB.* [5] at No. 1 Royd St. [6] Dr. James Nathaniel Rind (1793-1840) ; Ben. Med., probably nephew of the Survr. [I, 381]. DDn. 193 (45), 6-8-24.

The Surveyor General was a member of the Lithographic Committee which managed the press, and in July 1828 he reports that acting quartermaster-serjeant James Gordon had arrived, sent out by the Directors apparently in response to Hodgson's request of six years earlier. Having brought no apparatus, he was attached to Rind's press, and employed mostly on printing maps for the Survey[1].

Special sanction had to be obtained before a map of Gorakhpur city could be lithographed in 1828. The survey had been carried out by Wroughton [152], who wanted copies for the magistrate—for the Court of Directors—and another for record with the Revenue Survey—and, writes Herbert,

a fourth might be desirable to...the commanding officer at Goruckpore, and it is not even improbable that a demand for a fifth or sixth may hereafter arise. In the case of even three copies being required, it appears to me that lithography will effect the work with the same economy as the employment of copyists, while the perfect similarity of every impression is assured, without the labour of examining more than one, the proof impression. ...

I would further...employ an extra draughtsman in this labour, charging for him in a contingent bill. The draughtsman—...Mr. Tassin—proposes...drawing on a stone for 300 rupees, for which he will also colour any number of impressions. ... He is a very superior artist, and I do not think...unreasonable. ... There is no draughtsman in the office of the Lithographic Press capable of executing this work ; nor even in the office of the Surveyor General (supposing the current work could be deferred) is there any one capable of competing with Mr. Tassin as a draughtsman ; add to which that he has had some experience in drawing on stone, the river maps now publishing by Captain Prinsep...being executed by him [15–6].

The proposal was sanctioned, Herbert being allowed to exercise his discretion "in multiplying the number of copies for sale"[2]. Other maps including some from surveys in Assam by Fisher and Jones were drawn on stone in the Surveyor General's office, and printed off at the press. Useful work was also done in printing traverse forms for the revenue surveyors [160].

Thomas Jervis, a great advocate of lithography, records that

the Court of Directors sent out a lithographer. ... I believe they have sent out two or three at different times, but they have all died, sinking in part under mental disappointment, and possibly under maladies incidental to constitutions unsuited, or uninured, to India. They lived just long enough to teach some persons the nature of lithography, to set some local presses to work for ordinary purposes of business, and to satisfy the authorities and community of India of the immense value of this art[3].

[1] six Europeans employed, *B Dir & GR. 1833*, do not include Gordon ; DDn. 231 (166), 30–7–28.
[2] BTC. 16–6–29 (25–6). [3] Jervis (173).

CHAPTER XXI

ADMINISTRATION

Surveyor General of India; Appointments — Relations with Government — Duties — Revenue Surveyor General — Superintendent, Trigonometrical Survey.

THE order substituting a single Surveyor General of India, with headquarters at Calcutta[1], for the independent posts of Surveyor General at the three presidencies, reached India in November 1814, but it was not until 17th April 1815 that the Governor General nominated Colin Mackenzie to fill the new post [II, 306, 427]. The appointment, dating from 1st May, was promulgated at Fort William on that date, and repeated at Fort St. George on 26th [II, 307].

As Mackenzie had only recently returned to Madras after four years absence, he obtained permission to stay there in his new capacity to re-organize the department and raise field parties [94–5]. He writes in January 1816 ;

I have, since my arrival on 31st March, been employed without any intermission...in preparing...materials for a...view of the surveying establishment. ... In a few days I shall...submit an abstracted state of the Survey Department...from the 1st December 1810 to the 1st December last (a period of 5 years). ... [He asked time for] winding up the complicated duties of this office, and making...arrangements regarding the current wants of this Presidency[2].

In his absence, Crawford continued in charge at Calcutta till driven home by sickness in December 1815. The Calcutta office was then left to the charge of a subaltern [309], and field surveyors and Government left without professional guidance or counsel. After several polite enquiries an emphatic order was despatched in May 1817, the Supreme Government regretting

that circumstances should have protracted the arrival of Colonel Mackenzie in Bengal to this late period. His Lordship is the more urgently solicitous that an event so exceedingly desirable...should on no account be longer delayed, because upon its accomplishment depends ...the new system of general survey as ordered by the Honourable Court.

The arrival of Colonel Mackenzie...will enable that competent and zealous officer to see his way more clearly, and to mature his ideas at leisure, on the many subsidiary matters...which remain to be devised for the effectual accomplishment of the Honourable Court's designs[3], while...the...decisions of this Government...must be accelerated...by...discussion...on the spot[4].

Mackenzie closed down work at Madras, handed over the office to John Riddell, and reached Fort William on 29th July. He was now 64 years of age, and under the anxieties of his new responsibilities, and the trying climate of Calcutta, his health rapidly declined. After two years he was continually withdrawing himself in search of more salubrious air ; up the river to Palta ; down to the Sandheads ; and to Puri on the Orissa coast; there were no hill stations in those days. He died on the 8th May 1821 on a river trip, having spent 38 years in the east without any respite from duty other than his tour to the upper provinces in 1814 [II, 78, 426].

Much to the disgust of both Williams and Webb [280, 322], John Hodgson succeeded as Surveyor General from 25th May, Thomas Wood of the Engineers holding charge pending his arrival[5].

Although the Directors had nothing against Hodgson, who was indeed a most capable and experienced surveyor, they preferred Valentine Blacker, and nominated him Surveyor General under a letter of July 1822, whilst he was on furlough. Blacker was indeed one year younger than Hodgson, and less than two years senior by date of first commission, but he had had a distinguished military career

[1] CD to B 3-6-14 [II, 306]. [2] MPC. 3-2-16. [3] on the subject of revenue surveys [134–5]. [4] DDn. 142 (91-101), 6-5-17. [5] BGO. 30-5-21 ; BMC. 2-6-21 (14), BGC. 25-6-21.

as Quartermaster General of the Madras army from 1810, and right through the Marātha war, and the Directors entertained "a high opinion" of his "merits and services". Though he had not done much practical survey himself, he had commanded the Madras Guides, had been responsible for the surveys both of the Military Institution and of the Quartermaster General's Department, and had produced valuable maps of Central India after the last war [86, 282].

Assuming office in Calcutta on 24th October 1823[1] he administered the department with wisdom during the Burmese war, and strongly advocated the Great Trigonometrical Survey as the only sure basis for accurate survey [240–1]. After a brief illness he died in Calcutta on the 14th February 1826, in his 48th year.

Hodgson was re-appointed from 17th March[2], after two years as Revenue Surveyor General [305–6 ; pl. 21 n], and returned to Calcutta at the end of July 1826[3], retaining charge of revenue surveys. In December 1828, after 28 years continous service, he applied for leave to England with permission to retain his appointment, a request which could not be granted[4]. He was however granted furlough on medical certificate, and after handing over charge to Herbert sailed from Calcutta on 24th January 1829[5].

It was several months before the Governor General, Lord William Bentinck, selected Henry Walpole as successor, after calling for names of suitable candidates from the three presidencies. These names were ;

From Bengal.—Lieut. Col. Sir T. Anburey [I, 309] ; Captains Herbert ; Franklin ; Oliver ; Cheape. *From Madras.*—Major Walpole ; Captains Montgomerie ; Crisp. The name of Captain White[6], though not brought forward by himself, has been strongly recommended both by Lt.-Col. Conway[7] and Captain Troyer, under whom he was instructed in the Military Institution at Madras. *From Bombay.*—Captain Jopp, Deputy Surveyor General, and very favourably mentioned by Sir John Malcolm.

If I was restricted to a selection from...the Bengal Presidency, I should consider Captain Herbert entitled to a decided preference. His ability and zeal, together with his extensive contributions, not only to the immediate objects of the department, ... but to general science, entitle him to great respect...but, regarding...the views of the Court, ... and...their efforts to establish a general Map of India, and conceiving that it is from the want of system...that are to be found the causes of failure, I am of opinion that Major Walpole...is more competent than any other officer to place this plan upon a principle of progressive...execution [282–6][8].

On Walpole's assumption of duty on 30th October 1829[9], Herbert was appointed Deputy Surveyor General [310].

As in the case of Blacker, so also now, the Directors made their own selection regardless of that made by the Governor General, and in August 1829 they informed Everest, who was still on leave that they had appointed him Surveyor General, "entertaining a high opinion of your services as Superintendent of the Grand Trigonometrical Survey, and of your scientific acquirements and general qualifications"[10]. Everest returned to India and took over as Surveyor General on 8th October 1830, resuming charge of the trigonometrical survey at the same time [1, 10, 308][11].

RELATIONS WITH GOVERNMENT

The Surveyor General's department in Bengal had been controlled by the Military Department of the Supreme Government since 1785 [I, 262], having been under the Public Department during Rennell's time. From 1st June 1818, the Governor General directed its retransfer to the Public Department[12], being

altogether unaware of any sufficient reasons for...the Surveyor General's duties...coming under the Mily. Departt., or for placing expences of the office to the head of Bengal charges, Military. In the infancy of the British territorial possessions of India, and while a constant severe

[1] BMC. 24–10–23 (176). [2] BGO. 17–3–26. [3] DDn. 223 (38), 8–8–26. [4] BMC. 19–12–28 (151). [5] DDn. 231 (255), 26–1–29. [6] Henry White [II, 456] ; MRIO 156 (60) ; svy. of route, S. of Prome on Irrawaddy R., May, 1825. [7] Thos. Henry Somerset Conway (1779–1837) ; Mad. Inf. ; AG. Madras from 1809 ; Bt. Col. 1831 ; *DIB*. [8] GG.'s minute, MMC. 11–9–29 (45). [9] DDn. 231 (289), 30–10–29. [10] CD. Misc. 68 (2837), 25–8–29. [11] DDn. 265 (61), 8–10–30. [12] BMC. 5–6–18 ; DDn. 133 (83), 1–5–18.

struggle for existence was maintained, topographical and geographical knowledge was sought, chiefly with reference to its...use in a Military point of view. The early surveyors were therefore usually military men, and...their expeditions were naturally considered as incurred for military-political purposes only.

The continued employment of officers in the army as surveyors has arisen probably out of the peculiar frame of European society in India. Two classes of men only could lawfully resort to the country. The scanty pay...of a Surveyor held no temptations to the Civil class, but is an object of ambition to Military men, whose education...rendered them, ... perhaps, better qualified for such employment.

For some time past, however, an important change has been gradually taking place in the...character of the Survey Department. ... The consolidation of our Empire, it's complete military security, and the natural extension of its possessions and influence, have prodigiously added to the...surveys in India. ... We now distinguish between Topographical Surveys for purely Military purposes, and Civil Surveys, which may be said to comprehend on the one hand, the magnificent operations of the Scientific Geographer and, on the other, the minute but useful researches of the Land Surveyor...for statistical and financial enquiry. ...

The arrival in Bengal of Colonel Mackenzie, and his assumption of the important functions confided to him, offers a favourable opportunity for effecting this necessary separation. The Department of General Survey for India is...wholly new. If it is to answer the great ends contemplated by the Hon'ble Court—...if it is to render powerful aid to the internal administration by...those accurate district surveys so much wanted in Bengal, so happily effected by Col. Mackenzie in Madras, and now introduced at Bombay—...it must...receive such an organization as will adapt the engine to it's intended uses. ...

After the transfer of the...general survey to the Public Department, the Military Department will remain chargeable only with the topographical staff of the Army (Quarter Master General's Department) [334–7], but His Lordship does not purpose...that the Surveyor General should be prevented from availing himself...of the services of military officers. ... Agreeably to...the General Orders 1st Jany. 1817, ... separate surveyors were to be employed only when war, or the preparation for war, should preclude the Quarter Master General from placing the officers of his department at the disposal of the Surveyor General [334]. ...

The Surveyor General and his subordinates will become civil functionaries. ... No part of their emoluments, pay excepted, can be permitted...to burthen the...Military. ...

The Governor General purposes to consider the Surveyor General's office as...the grand depository of all...geographical and topographical knowledge regarding India. ... The trigonometrical operations of Lieut. Col. Lambton are only exempted from the jurisdiction of the Surveyor General for temporary and special reasons, which will cease to operate when the Lieutenant Colonel's charge shall devolve on a successor. ...

The Quarter Master Generals of the Armies under the several Presidencies will...furnish the Surveyor General with the originals, or copies, of every actual survey made under their orders...which the Surveyor General may wish to posess[1].

Lord Hastings rejected a suggestion that, because of its general confidential nature, the Survey should be placed under the Political Department, pointing out

how slender is the connexion of the Surveyor General's office with the *Political* Department. ... Whenever...plans or information are required in that branch...they will be supplied as they are at present. ... The probability, however, is that the maps wanted for political purposes will be generally executed for military objects by the topographical staff, and preserved in the office of the Quarter Master General, which is strictly the department of *military* survey. ...

In neither case can there be any difficulty in the Secretary's making his requisition direct; indeed the Honourable Court's instructions are peremptory, and enjoin the Surveyor General to keep his records strictly private, and to attend in person on the Governor General or Commander-in-Chief, when called on to furnish maps or information of importance. This system of vigorous secrecy has long prevailed in the Surveyor General's Office [II, 288][2].

The new orders laid a heavy burden on the Surveyor General, who had to keep separate accounts for " military surveys " and to correspond with the Military Department " on all questions...which may be strictly of a military character "[3]. Mackenzie was far from happy and writes privately to the Military Secretary;

A machinery under directions from one Department cannot be satisfactorily managed in another. ... It is the collision with other Departments that I dread, because I have experienced such detriment already from it. I am also anxious to be apprized of the appropriate channel

[1] to VP. in Council, Mil. Dept., Camp Oochar, 6–1–18. [2] from Sec. to GG., Mil. Dept., 16–4–18.
[3] DDn. 133 (249), 31–7–18.

of communication with the Governor General. ... There is much in this department to be explained to him, but how is it possible for me, grey headed in this line, to received communications only thro' the Quarter Master General in what I have ever been taught to look to as my proper line of duty ?[1]

The new arrangement did not last long, for in 1822 the Directors ruled that,

as the principal surveys made in India are for Military and Political purposes, and the Surveyor General, as well as the officers employed under him, are usually military men, ... the regularity of public business would be better preserved by retaining the Surveyor General's office in the Military Department agreeably to former practice[2].

With brief exceptions, Madras surveys, other than those under the Quartermaster General, had long been a civil charge, and in 1828 it was ruled that all expenditure of the Surveyor General's department in Madras Presidency should be charged "in the Civil Department", from 1st May[3].

DUTIES

The Directors had laid special stress on the Surveyor General's maintenance of a central depot of geographical materials, and preparation of district or province maps, and of a general map of India [274, 289–10]. His responsibilities regarding initiation and control of surveys, and control of surveyors, were not precisely defined, except for the enforcement of secrecy, and it was generally held that existing regulations continued in force [193]. In Bengal these comprised orders that had been issued during the last thirty years or more[4], whereas Madras regulations were first issued on 9th October 1810 [II, 299].

The idea that the surveys of all three presidencies could be controlled from Bengal was by no means universally welcomed and, writes Hodgson to Crawford,

I am quite anxious to know if we are to have the good fortune to retain you as our Chief; I hope so. Surely Lord M [Moira] will see the absurdity of the new arrangements, for, if the Survey Department is thought worthy of keeping up, it is evident that a Surveyor General here can have no adequate means of judging of the accuracy or merit of his subordinates, acting perhaps in Guzerat, or Lord knows where. They might as well order one Superintending Surgeon, or Reviewing General, for the 3 Presidencies ; 'tis not by this sort of œconomy that the arch-enemy Buonaparte acted[5].

It was, indeed, impossible for the new Surveyor General to assert control in all three Presidencies with any effect without suitable deputies. For two years Mackenzie made no attempt to make contact with surveys in Bengal and Bombay, and confined himself to overhauling the surveys in Madras, where he was completely at home. Before leaving for Calcutta in 1817 he obtained authority for the establishment of a small branch office under an Assistant Surveyor General, instead of handing over the depot of maps to the Chief Engineer as had first been ordered [315–6].

After arrival in Bengal he took some time to get a grip of the work. He found it particularly galling that the Quartermaster General should have a separate staff of military surveyors ; and that many of his own surveyors had, in his absence, been taking orders either direct from Government or from local officers [334–7].

It appears to me...that the mode of communicating with the few surveyors employed under this office should be defined, and either the former regulations observed, or new ones made.

Regarding the survey of Sirmoor, ... I know not officially who has charge of it, as Captain Hodgson writes me privately he is coming away on ill-health [35, 328–9]. Lieut. Herbert is detached under instructions unknown to me ; and I must hesitate...on giving any, as my attempts are frustrated by measures taken without my concurrence.

It would be useful...if I could have the honour of seeing His Lordship, as more could be explained personally then can be well done in writing. I am quite exhausted, and...to little purpose, as...nothing...can prevent it excepting an adherence to the former rules, or the establishment of others modified to the present state[6].

He found that Franklin in Bundelkhand [81] had not sent in

[1] DDn. 154 (35), 30–9–18. [2] CD to B., Pub., 17–7–22 (2). [3] MGO. 15–4–28. [4] *Carroll's Code*, 1812 ; *BM Regs*. 1817. [5] DDn. 136, 11–7–15. [6] to GG.'s PS. ; DDn. 154 (27), 18–10–18.

the plan he promised in May 1817. ... I am entirely unable to estimate the extent of that survey, how far it may connect with others (such as Sackville's) & many other points necessary for my communicating his instructions. He has never reported his leaving the survey. ... All officers coming under...the Surveyor General should report their coming on survey & then leaving it ; as well as the periodical reports & returns that are required[1].

Again to the Private Secretary after discussing some new proposal ;

I have really to apologise for occupying so much of your time yesterday. I thought it very necessary that you should have a distinct understanding of the complicated duties that hang so heavily on my shoulders, ... wherein no one can relieve me, and in which I am engaged from motives of public feeling rather than...my personal comfort, interests, or satisfaction. ... The following principal objects must have a temporary suspension.

1. ...The State of the Surveying Department, together with all that depend on it. This I consider a primary object.

2. The correspondence with Madras, in arrears and almost confusion, from the contradictory measures taken there, ... to be...brought to that proper situation in which I left it[2].

3. The communications and correspondence with the new surveys ordered in the Poona ...territory, which require to be understood, to prevent that excess that threatens [124, 321].

4. The necessary communication to the surveys of this Presidency.

5. Replies to a number of requisitions from Government now in arrears. Very heavy and formidable for one to go into.

6. The current office duties as established by me occasion no extra attention ; but besides these is— 7. The Telegraph Committee, which frequently, and at this very moment requires a serious consideration [270] ; add to that— 8. The communication and correspondence on the survey lately ordered for exploring a new road to Nagpoor [27–8].

I trust that any delays that may occasion on this head, and several others that I could mention, will not be imputed to any neglect in me[3].

Work became no easier with his illness ;

I have been so exceedingly unwell for the last fortnight that at the earnest recommendation of the medical men I was obliged to leave town on the 9th to reside at Pulta[4] for the benefit of a change of air. I came down today (tho' not to the advantage of my health) in consequence of numerous official letters which I could not answer from Pultah. ...

The...claims for surveyors' allowances, the frequent discovery of further surveys of which no official notice appears at the office, and the applications for rates of allowances or certificates from me (which is the only occasion apparently where the Surveyor General is now called upon), tends to increase this...embarrassment, and points out the necessity of a speedy remedy.

The main object of this office, meantime, is thrown back, and the weight thrown upon me is very injurious to my health, and now retards the means recommended for my relief[5].

As pointed out elsewhere, he was worried by Lambton's proposals for special increments for his staff [307, 325], and was greatly disturbed by Garling taking instructions from the Resident at Hyderābād [117] ;

Colonel Lambton's survey, ... which was originally designed to assist and not to embarrass, ... is a serious subject that I ought to be allowed time for, and the principal object of all, the actual state of the survey department, is still kept back by the mass of detailed matter that has fallen upon me, to the loss of my health, and almost of my resolution.

Mr. Russell of Hyderabad has at last proceeded to the length of ordering away the surveyor... on a scheme of his own, ... in opposition to all I have proposed. ... What becomes of the Surveyor General's office then ? or what is the use of it ?

Are these matters to be regulated by these gentlemen at pleasure, or why should I alone be kept in the dark ? If this office is to be merely nominal, it may suit very well any person desirous of a salary, but I conceive neither my course of service, nor any other reasons, would warrant my being laid aside, or employed in a situation of considerable responsibility, without power of acting according to the line apparently down for my guidance. ... I am sure you will forgive me for suggesting that all orders, etc., relating to the Survey Department be communicated to the Surveyor General, ... and that no officer of Government be permitted to interfere with surveyors, excepting in cases of urgent necessity[6] [341].

He remained suspicious and jealous of the Quartermaster General to the end, and less than three months before his death complained that he had only just been

[1] to QMG., DDn. 154 (2), 1818. [2] De Havilland's demands for maps [277] ; Garling's work for Henry Russell [116–7]. [3] DDn. 154 (74–5), 10–3–19. [4] about 18 m. north of Calcutta, on left bank of Hooghly. [5] DDn. 154 (93–4). 10–8–19. [6] ib. (111), 5–11–19.

informed of the new scheme for road surveys [27]; "little of the former duties are now left to the Surveyor General's Department "[1].

Mackenzie was indeed exceedingly jealous and touchy at any trespass on his prerogatives, and constant ill-health greatly exaggerated his difficulties. Government was consistently considerate to his protests; they encouraged him either to refuse troublesome applications, or refer them to higher authority, and authorized him to correspond direct with the Government at Fort St. George.

The inception of the revenue surveys and of the new quarter-inch atlas brought new problems for his successors, and the extension of surveys into Marātha territories, and to Burma and Assam, soon relieved the tension with the Quartermaster General, especially as Blacker knew both ends of the question so well. He found it desirable, however, to have his position clarified by the following rules, that were "entirely grounded on the instructions of the Hon'ble Court of Directors".

That no new survey shall be undertaken at the subordinate Presidencies without the sanction of the Supreme Government, and that an opportunity be given to the Surveyor General to report on the qualifications of the surveyor and on the capability of his instruments.

That an officer once appointed to a survey shall not be removed from it without reference to the authority by which his employment was sanctioned.

That the Surveyor General be authorized to dictate, under the approval of the Supreme Government, the scales which shall be used, and the forms and manner of preparing the memoir of the survey; to call for detailed reports of practical operations, and to be obeyed in such instructions as he shall find it necessary to issue thereon[2].

These rules were issued under General Orders of the Supreme Government dated 6th January, 1825, together with others which gave the Surveyor General official access to the survey records of subordinate presidencies [292].

REVENUE SURVEYOR GENERAL

Though the Directors had long been anxious for a start to be made on the revenue survey of the Upper Provinces, Government had not been able to get any concrete help from Mackenzie [135], and it was not until Hodgson succeeded as Surveyor General that they received definitely proposals, and enthusiastic co-operation. Several parties took the field during 1821 and 1822, organized and controlled by the Surveyor General, who found his work so much increased that he obtained the assistance of Herbert at headquarters. On Blacker's arrival in 1823, a new post was created for Hodgson—Revenue Surveyor General—

The number of Revenue Surveys actually in progress, with the prospect of still more, ... appears to dictate...some special arrangement for...efficient superintendence. ...

There are now five parties conducting minute village surveys in the Western Provinces and in the Dehlee Territories. ... In Bengal there are three surveys—that of Lt. Fisher on the Sylhet frontier [144–5]—that of Captn. Blake on the coast of Bullooah and the adjoining Islands [138–9]—and that of Mr. Prinsep in the vicinity of the Soonderbuns [141–2]—all engaged under the Civil authorities. ...

In the above surveys, 10 commissioned officers, and 14 uncovenanted assistants and apprentices, are employed. Already therefore they considerably exceed in number the persons employed in general geographical surveys.

The nature of their operations—involving the accurate ascertainment of the boundaries of ...villages, with...minute information in regard to the extent of the cultivated and uncultivated lands, and other points of statistics—requires that the books and statements furnished by them ...should be detailed. ... The examination of these...involves a corresponding degree of labor. ...

The Revenue Surveys, even as now constituted, occupy as much of the Surveyor General's time and attention as all the general surveys throughout India. ... Without a careful supervision over the executive officers, we can have no adequate assurance of the sufficiency or correctness of their work, and we cannot hope to secure a full return for the charges...which, if the survey be successfully prosecuted, will doubtless be repaid to us tenfold.

[1] DDn. 196 (5), 15–2–21. [2] DDn. 204 (114), 1–10–24.

Adverting to the zeal which Captain Hodgson has evinced in forwarding an object long anxiously desired both by the Court of Directors and by this Government, ... and to the experience which he has obtained, ... Government might still...retain...his services. ...

Now therefore that Major Blacker has assumed charge of the Surveyor General's office, no advantage whatever will result from continuing the existing connexion between it and the Revenue Surveys. On the contrary, ... the superintendence of these surveys would only tend to embarrass that officer. ... Superintendence of the revenue surveys will unquestionably afford ample employment to a single officer. ...

The Governor General in Council resolves that a new office be constituted under the designation of Revenue Surveyor General, for the...direction of the various village surveys now in progress, or which may hereafter be instituted. ... The situation of Captain Hodgson, and the part he has taken, ... point him out for the office, and the Governor General is...pleased to resolve that he be appointed Revenue Surveyor General. ... Personal salary of Sa Rs. 1,200 per mensem, with a monthly allowance of Sa Rs. 350 for office rent in addition. ...

As to establishment, Captain Hodgson will...furnish a statement of what he may consider necessary. Every possible attention must be paid to economy; but the establishment must necessarily be enlarged...as the number of surveys...increase. ... Considerable advantages will probably result from his occasionally visiting...the surveys...in progress, and holding personal communications with the officers conducting them. ... The above allowances are to cover all expences incurred on account of travelling charges and the like. ...

He should have some fixed office, more especially as the maps and records will rapidly accumulate, and...he should have under him some intelligent person in the capacity of Register, who may look after the office...during his occasional deputations [314]. ... At the expiration of each year he will...report on the progress of each of the surveying parties[1].

Hodgson planned an early move from Calcutta to Rohilkhand by river,

taking with me the assistants and apprentices belonging to the Territorial Branch, that the more advanced apprentices may be supplied to the surveys in the field, and the juniors...receive instruction in the office, and...preparatory practice in the open field which...is almost impossible to give in Calcutta or in the climate of Bengal. ... It is my wish to train up the young men ...to such habits of hardihood and industry as they can never acquire in this city [361, 363].

Also I am in hopes of being able to teach some of the intelligent natives of the Upper Provinces as much of the practical art of land surveying as may make them useful and cheap aids to the surveyor [389–90]. ... I am...anxious to visit the several survey parties in the Upper Provinces, and to confer with the members of the Western Board of Revenue. ...

I...propose...to proceed by water towards Bareilly in the beginning of the next month [December 1823]. The people of the office being with me in good boats, the internal work of the department will proceed with as little, or indeed less, interruption than in Calcutta[2].

He made headquarters at Fatehgarh [151], until recalled to Calcutta in 1826 on the death of Blacker. He then waited till July before he moved, for in the hot weather

boats are hardly procurable, and there are several impediments to rapid progress by water. I therefore propose to defer my departure till the commencement of the rains, when I intend to proceed to Calcutta as fast as possible, taking with me the office records...and those persons ...whose services will be required there[3].

He was allowed half salary of Revenue Surveyor General in addition to that of Surveyor General, as the two departments were distinct,

that of the Surveyor General of India being under the Military [303], and that of the Revenue Surveyor General under the Territorial Department, and the duties and expenses of each must necessarily continue separate. On my re-appointment I ceased to draw my salary of 1,200 sa. Rs. as Revenue Surveyor General from the 16th March, drawing instead of it that of Surveyor General of India, which is sa. Rs. 1,435, ... a small allowance for the head of so very extensive a department, and in which there are no less than 33 commissioned officers employed in different parts of India [310]. ...

As I have conducted the duties of the Revenue Surveys from their first establishment, I do not wish to be relieved from them. ... I respectfully solicit that...I may be allowed to draw 600 sa. Rs. per month, being half my former salary as Revenue Surveyor General...from the 17th March, being the date of my appointment [301][4].

On leaving India in January 1829, he handed over to Herbert who, on Walpole's succession as Surveyor General, became Deputy Surveyor General in charge of Revenue Surveys, an office that was not abolished until 1905.

[1] BTC. 23–10–23 (53). [2] from RSG. 4–11–23; BTC. 20–11–23 (49). [3] ib. 26–4–26 (43). [4] Letter of 16–9–26; sanctioned under BTC. 21–9–26 (38 *et seq*).

Before 1818 Lambton's official designation had been simply as "on a Survey", or "on General Survey", and though he was sometimes addressed by Mackenzie as "Superintendent of the Trigonometrical Survey", this term was not used by Government or himself, until his transfer to the Supreme Government [I, 225].

From the time of Mackenzie's appointment as Surveyor General of Madras in 1810, it had been ruled that, though in no way under his orders, Lambton should submit to him quarterly returns of establishment and expenses, for submission to Government with those of other surveys [II, 335]. This arrangement was continued on Mackenzie's appointment as Surveyor General of India, and from 1817 Lambton submitted these returns through the Assistant Surveyor General at Madras.

On the transfer of Lambton's survey to the Supreme Government with title "Great Trigonometrical Survey of India", and Lambton as "the Superintendent thereof", the Trigonometrical Survey was placed

immediately under the Public Department, and wholly distinct from, & independent of, the Surveyor General of India ; but as this measure is adopted out of respect to the rank, talents, & eminent services of the present Superintendent, in the event of that officer's ceasing to hold the direction...the Governor General will consider this regulation as open to revision.

Lambton was further directed to put forward proposals for revising the pay and terms of service of his staff on their transfer from Madras[1] [304, 379], and these proposals were passed to the Surveyor General to report "how far they correspond with the general rules established with regard to the Department under your charge"[2]. Mackenzie thought them far too generous, but, instead of dealing with them promptly, put them aside—grumbled about them to Mountford—and in spite of repeated reminders eventually left them as a legacy for his successor. He appears to have agreed heartily with Riddell's comment ;

Now that the Governor General is at Calcutta, I trust that you will soon get everything arranged according to your wishes. The incongruity of three independent departments[3] will of itself appear, and...they will...turn their eyes to you as a channel of communication between the Trigonometrical Survey and Government. ... I cannot conceive how a survey of which the principal end is to serve as a basis to other undertakings...can be separated from the Surveyor General of India. The scientific part might perhaps be kept apart, or communicated direct to Government, but, for the rest, I cannot see how you can be passed by. As, however, you yourself say, patience will bring about everything[4].

The need for closer co-operation was in fact recognized by the Directors, who held it consistent with previous orders to place the Trigonometrical Survey

under the general superintendence of the Surveyor General of India. ... We do not mean that the operations of Colonel Lambton should be interfered with, but that report of his progress should from time to time be made to the Surveyor General for the use of his office, and for our information, and that the Surveyor General should...call for quarterly returns of expenses, and for estimates of the time required to complete survey on hand[5].

Lambton had no objection to sending copies of his professional reports and charts in this way, but was extremely galled by Mackenzie's continued failure to deal with his application about establishment, and the inconvenience of having

my propositions submitted to the Surveyor General, nor can I conceive what he can have to report upon them, except what may immediately appertain to surveys in their literal sense, and where he may wish to be supplied with data. ...

When I was first crossing the Peninsula, and when the Mysoor Survey was carrying on, my communication with the Superintendent of that survey was...discretional, and...never intended to draw my attention from the main object, ... General Geography [II, 115–6]. ... In the letter from the Honorable the Court of Directors...dated the 7th April 1819, paragraph 158 says "We do not mean Colonel Lambton's operations should be interfered with". ...

I have only this request to make, viz., that I may hereafter be freed from every kind of embarrassment occasioned by referring to any subordinate authority, because I cannot but believe myself the best able to explain the objects which I have in view, and that I may be left entirely to myself, so far as is consistent with the authority of Government[6].

[1] GG. to VP in C., 25–10–17 ; DDn. 142 (227) BMC. [2] ib. (253), 13–1–18. [3] under SG. ; QMG. ; Lambton. [4] DDn. 151 (211), 4–7–18. [5] CD to B., Mil., 7–4–19 (157–8) ; DDn. 144 (373–4). [6] to Pub. Dept., DDn. 196 (37), 21–8–20.

This brought a heated reply from Mackenzie who complained that Lambton

not only animadverts on my conduct for not passing certain propositions of his, ... but proceeds to attack the measures of Government in appointing an office of Surveyor General. Soon after my arrival from Cuttack I was taken so ill as to be prevented from taking up Colonel Lambton's business as I intended. ... These proposals may lay over till I am enabled to extract... information...that will be necessary previous to decision [304].

I...regret that that officer's branch should again unnecessarily tend to interrupt the course of the Surveyor General's duties, which it was originally intended rather to assist, and never interfered with...for twenty-two years that I have been repeatedly in contact[1].

Mackenzie's unhelpful attitude was due entirely to ill-health, and his inability to concentrate on papers that had been awaiting disposal for over three years. His petulance was not consistent with the friendliness that had persisted between him and Lambton since the early days in Mysore [II, 115–21]. Both these great men laid down their tasks within the next two years; Mackenzie indeed within the next three months.

After Lambton's death, Everest was appointed to succeed as Superintendent, and

placed under the regulations affecting the Surveyor General's Department, and...all future reports from the Superintendent...transmitted to the Surveyor General of India, through which channel the orders of Government connected with the Great Trigonometrical Survey will in like manner be communicated[2].

Before confirming his appointment, the Directors called for a report on the real necessity to continue the survey [240], and insisted on

great caution in the selection of an officer to fill the vacancy. ... Satisfactory testimonials of his qualifications as an astronomer and mathematician may be submitted to our consideration, without which the nomination will not be confirmed or sanctioned[3].

There was never any friction between Everest, as Superintendent of Trigonometrical Survey, and the Surveyor General, whether Hodgson or Blacker, but it was probably just as well that on his return to India he was appointed to fill both appointments; he would not have worked comfortably under a Surveyor General who exercised any close control.

On his departure on sick leave in November 1825 [246], the Directors were anxious to fill his place if a suitable officer could be found, but, except for Herbert whose services could not be spared, there was no one whom the Surveyor General would recommend [242]. Everest himself explains that

there was no officer in India who had any practical acquaintance with the methods pursued in the Department. ... I do not by any means presume to question the talents of others, but simply to state that any person who might at that period have taken upon himself the task of conducting the operations in my absence, would have had to learn those methods which I had acquired by the toil of a seven years apprenticeship. ...

There never were more than two individuals besides myself who had been assistants to Lieut. Colonel Lambton, viz., Captains Warren and Kater—of whom the former was residing at Pondicherry out of the service, and the latter was in England—and...none but the Lieutenant Colonel's assistants were allowed to use the larger instruments, or to have any share in the higher parts of the profession. ... The difficulty of nominating my successor was...such that the late Colonel Blacker...preferred recommending Government to keep my situation open until my return, and in the meantime to employ the establishment...as I should suggest. ...

It is not upon record that any individual at that time was bold enough to stand forward to grapple with an occasion for bringing himself thus prominently to the notice of the scientific world. Moreover, the Court of Directors had most decidedly declared that they would not permit the appointment of an officer...who could not produce substantial proofs of his abilities as a Mathematician and Astronomer, so that the list of those who were eligible was limited, and of these it does not appear that one stepped forward to court the dangerous honour[4].

[1] DDn. 196 (5-6), 15-2-21. [2] MMC. 7-3-23; DDn. 197 (2-9). [3] CD to B., Mil., 29-10-23 (10-1).
[4] DDn. 283 (25), 5-2-32.

CHAPTER XXII

OFFICE ESTABLISHMENTS

BENGAL ; *Assistant Surveyor General — Office Premises — Office Staff — Revenue Surveyor General* — MADRAS ; *Riddell, 1817–8 — Mountford, 1818–23 — Mountford & Montgomerie, 1823–30* — BOMBAY, *1821–30 — Great Trigonometrical Survey.*

JOHN Hyde, appointed "Assistant to the Surveyor General" at Calcutta in April 1814 [II, 296–7], took sick leave to New South Wales in December, and did not rejoin till February 1816, so Crawford, who was leaving for Europe, obtained the services of Hugh Morrieson from October 1815 to bridge the gap.

Hyde had originally been appointed to assist with astronomical observations, but the Directors considered the appointment unnecessary, and directed "that it be immediately discontinued". At the same time they asked for a report from Mackenzie[1], who had no doubt whatever about the necessity for an assistant, and expresses himself freely in a private letter ;

I cannot see how the duty can be done without one assistant at least ; but certainly not for the duty proposed by Colonel Crawford in 1813. ...

My dear Sir, I could seriously wish that no further change were made in the office till the whole State of the Department is brought under review of Government. To do this I certainly require assistance that I do not think can be obtained from any person unacquainted with the routine of office duty. ... What I consider most necessary is to have the Office and Department brought into a regular systematic order, and its duties well defined. ... I am labouring to bring this forward [303–4], and to carry on the current duties at the same time, of which the latter is not difficult with the people I brought round [311–2].

Mr. Hyde...has been useful, and is willing[2].

Hyde's appointment was confirmed, but in December 1817 he was again granted leave, this time to Fort Marlborough in Sumatra, rejoining in July 1818[3]. Whilst his return was uncertain Mackenzie discussed the possibility of appointing James Franklin, but noted that the pay was

only 250 rupees, and attendance expected from 10 till 4. Another of my ideas would be to make the situation of an assistant in the office a qualification rather for being sent out on survey with superior allowance ; this instruction would be useful to a Surveyor[4],

He did not find Hyde an ideal assistant, and wished he had one like Mountford, for whom he had a great regard [318–9]. Hyde's pay was raised to Rs. 500 p.m., but it was unfortunate that he should take furlough in March 1821, just two months before Mackenzie's death. Thomas Wood, however, who knew the survey well [I, 398–400 ; II, 457], was in Calcutta and took charge pending Hodgson's arrival. Hodgson at once asked for the services of Herbert, who joined from Garhwāl in December 1821. Pending his arrival Claude Wade made himself useful in the office at a time when Hodgson was busy organizing the new revenue surveys, and he was kept on till September the following year [292, 312].

Herbert was withdrawn in February 1823 for geological survey in the Himālaya [268], and Cheape who took his place was sent off to the Chittagong–Arakan frontier [67], and then to military duty in Rangoon. He rejoined in March 1825[5] but in September was transferred to Public Works[6]. Blacker then brought Crisp up from Hyderābād for the double purpose of assisting in the office, and of re-arranging the records of his survey [118]. Crisp was thus available to take charge on Blacker's sudden death three months later, and after Hodgson's arrival remained

[1] CD to B., Mil., 7-1-17. [2] DDn. 154 (21), 12-9-18. [3] BGO. 11-8-18. [4] DDn. 154 (21), 12-9-18. [5] BGO. 23-3-25. [6] DDn. 201 (13-4), 13-1-25 & 231 (85), 4-2-28.

till November when he took two months leave before returning to Hyderābād. He was allowed to draw Rs. 500 p.m. in addition to his allowance as surveyor for the period he held sole charge[1]. Hodgson was then left without assistance till 1828, when he once more brought Herbert in from the field, reporting

the inefficiency of my office for want of a duly qualified officer as chief assistant. In October 1823 Captain Cheape, of Engineers, the Assistant to the Surveyor General of India, was detached from the office, and was employed on various military services during the Burmese War. On his return to Calcutta, he was on the 22nd September 1825 appointed to survey and report on the state of the New Jaggernath Road, and finally removed from this Department.

During...28 months[2], the salary of the Assistant, ... being 500 rupees per month, was not drawn, and consequently a saving of about 14,000 rupees has been made. ...

In this Department 33 commissioned officers are employed in the 3 Presidencies in various and distant parts of India [306]. ... The Surveyor General is engaged in...extensive superintendence and correspondence, which occupy much of the time required for...forming maps and attempting to...reconstruct the geography of this whole extensive country ; of attending to the operations in the observatory which require constant direction; in instructing...the sub-assistants of the office, and various other duties. ...

The second officer in a department ought to be one in whom the Government and the Principal could implicitly rely, and who, in the event of the sickness or unavoidable absence of the superior, should be capable of performing his duties ; an assistant who does not posses these qualities is rather a hindrance than an aid.

I...beg...that...the services of my former assistant, Captain Herbert, may be made available. ... His labours and his merits are...known to the Government, and I consider him as beyond comparison the most skilful officer in India in...the various branches of science necessary to the Geographer and Astronomer, and...he adds unremitting industry and activity.

Captain Herbert is at present Superintendent of the Geological Survey of the Himalaya Mountains [268–9], and...willing...to return to this Department. ... He is ambitious of being allowed the designation of Deputy Surveyor General instead of Assistant as before. ... In the case of an ordinary assistant I would not venture to make such a proposition, but Captain Herbert cannot be considered as such. ... I respectfully hope that some increase to the present very small salary...might be made. That salary is 500 rupees per mensem, which in so expensive a place as Calcutta must be considered as a very slender recompense for the second officer of a great department, supposing him to hold the station of Deputy[3].

Herbert was duly appointed Assistant, not Deputy, and took up his duties about the end of June [268]. He took charge of the department on Hodgson's departure till Walpole's arrival at the end of October 1829 [301], and then became Deputy Surveyor General with salary Rs. 750 p.m. [306].

OFFICE PREMISES

Crawford appears to have had his office somewhere in the region of Chowringhee, paying 220 *sicca* rupees house-rent, and drawing a consolidated allowance for house and office at 300 *sa.* rupees [II, 297]. Morrieson and Hyde drew rent at the same rate, their allowance of rank being Rs. 60 only. In 1817 Mackenzie moved into a larger building, No. 8 Russell St.[4], as he had brought a considerable staff with him from Madras, with several interpreters employed on his historical work [311–2].

The house that had been engaged for me since January 1816, tho' sufficient for our own accomodation, could not receive the office ; & in the house occupied for the Surveyor General's office there was not room, not only for my Madras establishment & materials, but scarcely for myself to sit in. Divided between two houses, the month of August passed very uncomfortably, & to this moment I have not been able to open up the collection from Madras. The dampness of the weather was another impediment. ... I have got into a fine large house on 1st inst., & the office is just removed into it, but as...the lower rooms are still too damp & require repairs before I can lodge the almiras in them, the whole regular arrangement cannot yet take place for some time[5].

In February 1818 Government approved his move ;

[1] DDn. 211 (26), 14–7–26. [2] Oct. '25 to Feb. '28. [3] DDn. 231 (85–8), 4–2–28. [4] *JASB.* IX, 1840 (79). [5] DDn. 156 (296), 5–9–17.

Altho' the house...appears to be charged at a high rate, the Vice-President in Council will not object to the rent agreed on, viz., Rs. 420, ... but does not...authorize any increase...on account of the addition proposed...to the building detached. ... The house...might be obtained on more favourable terms were it taken on a lease for a longer term than a twelve-month[1].

The agents[2] refused to make any such reduction,

having lately incurred an expence of nearly 3,000 rupees in erecting an out-house and improvements, for which...an additional rent was to have been allowed. ... Should it, however, be taken for 5 years, we are willing to waive the proposed increase of rent, and to let it to Government for that period at what is now paid, viz., sicca rupees 420 per month. The proprietor is...liable for the usual repairs, but not alterations unless previously agreed upon[3].

Mackenzie was allowed house-rent of his rank in addition to office-rent, but not tentage allowance. He and his family occupied part of the house, and the staff employed on his historical collections was accommodated in the small outbuilding. After his death Hodgson obtained sanction to purchase from his estate

4 large book cases, or presses, ... for the...safe deposit of the very valuable maps...many of which are injured by dampness and insects for want of a more free circulation of air, ... as they are too closely packed together in the presses, ... which are not sufficiently large to contain all the papers or the valuable instruments. ... I also request...to purchase an iron cabin-stove for the purpose of keeping the air in the record rooms drier in the rainy season[4].

When I took charge of the office, I engaged the premises on a lease of two years on my private account at the same terms, i.e., 445 rupees per month, of which 420 are allowed by Government, and it was with great difficulty that I hired the house even on those terms. ...

The materials in this office are always accumulating, and the increase will be unusually great when the Revenue Surveys are in progress. By the addition of these surveys...it will be much more than doubled, and...several apprentices for that branch are already engaged, and under instruction [361–3]. ... A great deal of space, and good lights, are required. ...

I have under my custody...in the house the whole of the valuable astronomical and surveying instruments for...my department and that of the Quarter-Master General, as also to meet the occasional demands of the...Madras and Bombay Presidencies, and of expeditions proceeding on foreign service [212–3]. They occupy much room, and it is necessary that they should be kept dry and frequently inspected, as do also the maps and records, and...they would run the risk of being damaged if removed to a house of inferior description. I find it also necessary to provide for the accommodation at night of some of the assistants... that they may be in readiness to aid the occasional astronomical observations. ...

In no department at this Presidency is dry and spacious official accommodation so necessary as in that of the Surveyor General[5].

Blacker moved to 37 Park Street, which he took on a five year lease, occupying part of it as his private residence, and adding an astronomical observatory [187–8].

The terms on which this house (...one of the most appropriate about Calcutta) is engaged is 450 sicca rupees per mensem. It is no part, however, of the present proposition that Government should...increase the existing rate, ... but that it shall be obligatory on the Surveyor General of India, ... to make up the difference from his personal rent[6].

OFFICE STAFF

In 1815 the Surveyor General was still limited to the establishment authorized thirty years before, viz., one native writer @ Rs. 50 — 3 harkaras @ 5 each — 3 lascars @ 7 each — 1 *darwān* @ Rs. 4 — and 1 *sikligar* @ Rs. 4 — besides draughtsmen to the limit of Rs. 600 a month [I, 236, 262, 290 ; II, 274 n.3]. The full sum, Rs. 694, was drawn monthly as a matter of routine, and from time to time sanction was obtained to engage extra men for purely temporary purposes[7].

On his move from Madras Mackenzie was allowed to bring up, on increased pay, a number of surveyors, clerks, and draughtsmen, with seven interpreters and translators for his archæological and historical researches[8]. Several of the Hindus, including Lechmya, travelled the whole way from Madras by land, as their "customs of cast" did not allow them to go by sea [I, 40, 362].

[1] DDn. 142 (267), 17–2–18. [2] Messrs. Fairlie, Fergusson & Co. [3] DDn. 196 (142), 7–3–18. [4] ib. (78), 30–7–21. [5] ib. (139–41), 5–11–21. [6] DDn. 204 (45), 4–2–24. [7] such as extra draughtsmen, R. 340 p.m. [II, 272]. [8] DDn. 142 (199–200) 11–11–17.

Amongst those brought up were—Lucius Rawdon Burke[1], Register, or Registrar, who had been with Mackenzie since 1800 [II, 303]. He was promoted from Rs. 300 to Rs. 325 p.m. from 1st January 1820 with house-rent allowance Rs. 50 p.m.—Scott, Hamilton and Marcellus Burke, field surveyors, who worked in the drawing office to start with [pl. 2 n]—John Newman, one of the best draughtsmen, who died a year later. Mackenzie writes to Riddell regarding their move ;

Write immediately to Hamilton & Burke to come on [101]. ... I am anxious, as, tho' a very good young man, the former is unfortunately of a short temper that may not always conciliate. We are much in want of assistants. There are frequent enquiries what detains them. They want much surveyors for Cuttack [17], but I want Scott & Hamilton for the office, as there is not a soul here capable of doing what they can do, & it is a real loss to these lads that they did not come on, as every month they stay their loss will be more.

I have got Newman a good pay [R. 120], & he merits it, considering his qualifications compared with what we found here. If you could send me 2, 3 or 4, draughtsmen of the same kind, I would find employment for them[2].

Newman went sick and arrived back in Madras "rather better...than when he left Calcutta, but still looking very ill"[3]. Mackenzie lamented his death ;

I am sorry for poor Newman's fate, the only man I had who understood perspective in any degree. We shall have no want of draughtsmen, but I shall miss him as one of my own rearing, that I took a pride in[4].

Recruits entertained in Calcutta included John Stuart May, who was engaged from 1st January 1819 @ Rs. 200 p.m., "chiefly for the purpose of transcribing Lieutenant Colonel Lambton's Memoirs", and was a year later promoted sub-assistant on Rs. 240[5]. In discussing his appointment, Mackenzie writes ;

In employing any new person, we must not overturn the old scale. The death of one of my draftsmen would enable me to entertain him with less difficulty, but his skill in drawing is not equal to that of the man I lost [Newman], who was a half-caste, and if Mr. May, an European, was to get more, the whole of my Madras Establishment would be in arms and overset, and it is by them alone I am enable to carry on the current duties[6].

May was appointed Superintendent, Mātābhānga River, from June 1820, but carried on the Surveyor General's strength till 1825 [15–6].

After Mackenzie's death his establishment of interpreters and translators was broken up [391], some of them being given temporary employment under Horace Wilson, Secretary of the Asiatic Society, who arranged and listed all the historical material that Mackenzie had brought to Calcutta[7].

The full establishment of the office on 30th April 1822 comprised [360]

Captain J. A. Hodgson	.. Surveyor General from 25th May 1821.
Lieut. J. D. Herbert	.. Assistant to the Surveyor General from 14th Sept. 1821 [309–10].
Lieut. C. M. Wade	.. Temporary Assistant from 17th Aug. 1821 [292, 309].
Mr. L. R. Burke	.. Registrar from 11th Nov. 1817.
William Scott	.. Surveyor Instructor to apprentices [12, 19].
Henry Hamilton	.. Surveyor, Head Draughtsman.
Marcellus Burke	.. Surveyor [17–9].
J. Andrew Macpherson	.. Draughtsman ; 5-year apprentice from 8th Nov. 1813 [II, 273].
Thos. Lockwood	.. Draughtsman...since 1814 ; 1822, with Ferguson in Surguja [88].
Arthur Fitzpatrick	.. Apprentice-draughtsman-surveyor [22].

Mustie, Gould, C. H. Burke, and Foy, apprentices, were employed in the drawing office before being posted to field surveys, but Lockwood alone fell under the standing grant of Rs. 600 for draughtsmen. The majority accompanied Hodgson when he became Revenue Surveyor General, and, on becoming Surveyor General, Blacker objected to drawing a routine allowance for an establishment that did not correspond with actuals ;

On the separation of that part of the office establishment which accompanied the Revenue Surveyor General, I found my number of draftsmen and other servants so incomplete as to render their amount of pay considerably less than the allowance granted by Government. ...

The first abstract I have had occasion to sign...has been for the month of November last, and to it was attached a declaration upon honour that the sums charged have been necessarily

[1] His mother d. Madras, 8-12-22. [2] DDn. 156 (306), 28-11-17. [3] DDn. 151 (162), from Riddell 6-4-18. [4] DDn. 156 (375), 1-8-18. [5] DDn. 145 (21), 7-1-20. [6] DDn. 154 (53), 19-12-18. [7] Horace Hayman Wilson (1786–1860) ; Ben. Med. 1808 ; *DNB.* ; Assay Master 1816–32 ; bust, ASB. Calcutta. Wilson, H.H.

incurred...for the purposes set forth. However obviously this was at variance with the actual state of the case, I have...to put my name to it, in order that the individuals concerned, now two months in arrears, might receive their pay without longer suspense. ...

The balance remaining in my hands amounts to sicca rupees 353-13-7, or sonat rupees 369-12-7, and I request you will favour me with orders how I am to dispose of it[1].

With the hands I have at present employed, I cannot consider the office efficient, but I spare no endeavours to complete it, and, have even written to Madras with some success to procure competent draftsmen from that place; but even altho' I had the establishment complete, it will be continually liable to variation; for...the amount of salaries for draftsmen can never...accord exactly with the established allowance of 600 sonat rupees per mensem. ...

I...propose...that I...make monthly a bonafide charge, supported by the usual attestation, and a nominal list if necessary, for the sums I shall actually disburse for the pay of draftsmen, provided the same shall not exceed monthly the aggregate amount of 940 sonat rupees—... 600 sonat rupees established allowance, and contingent limit of 340—... and that any further contingency for draughtsmen be inadmissable. ...

These is an allowance of 50 rupees for a writer, and pay for 1 darwan, 3 lascars, 3 hircarrahs, and siglegar, which will remain untouched by the above proposition [I, 290][2].

Though draughtsmen were always difficult to find, he was able to trench on the established allowance for draftsmen...in order to defray some other expenses. ... One Writer only is allowed by the regulations, which were framed in 1788 for a Surveyor General of Bengal, but experience has shown me the total insufficiency of a single hand for... this office, ... and I have accordingly employed two clerks[3].

The acquittance roll for February 1824 shows Rs. 530 spent on draughtsmen;

Draftsmen [in addition to Henry Hamilton. who drew Rs. 323 as Chief Draughtsman].

Mr. A. W. Tudor,[4] from the 17th to the 29th February @ Rs. 150 p.m.	Rs.	65
Thos. Lockwood	„	70
Benjamin Saxton [360 n.1, 372]	„	60
Thos. Newey	„	50
Ditto paid at Madras from 22nd November to 31st January, inclusive, @ Rs. 50	„	115
Sheikh Abdulla	„	70
Sheikh Deen Mahomed	„	60
Sheikh Neejeeboollah	„	40

Writers, One at Rs. 40, one at Rs. 25

The roll for December omitted Tudor, Lockwood, Newey, and substituted J. W. Wymyss @ Rs. 100; Andrew Jewell @ Rs. 70; R. Dashwood, Rs. 50[5]. Wymyss had been brought up from Madras on a three year contract, and was allowed an additional Rs. 20 p.m.[6]. The names of all these draughtsmen appear frequently on maps still preserved at Dehra Dūn.

Amongst men brought from Madras was an "artist", otherwise instrument repairer, named Saiyid Mir Mohsin Husain, whom Blacker had found working with George Gordon, a well-known jeweller of Madras [258 n.2, 260], and had engaged for the Quartermaster General's office there. He was now sent for to take charge of the many instruments at the Surveyor General's office, for which the authorized *sikligar* was completely useless [188]. Being promoted to Rs. 35 in April 1827, he later won the notice of Everest and became Instrument Maker to the department and retired after more than thirty years service.

In January 1825 Vincent Rees, a well-educated Swiss, was engaged in place of May on salary Rs. 240 p.m. for computing astronomical observations [188]. He continued in the office, under various designations, for the next twenty years.

After the death of Hamilton, June 1826, John Graham was brought down from the Delhi revenue survey to take over duty as Head Draughtsman[7], a post which he continued to hold till his retirement in 1858.

There was always a shortage of competent writers, more especially for the tedious business of copying journals and field books, as Hodgson points out when the Directors complained of some being carelessly copied [292].

It is extremely difficult to procure at low salaries in Calcutta native copyists who have a sufficient knowledge of the English language to transcribe correctly any papers but those

[1] DDn. 204 (75), 14-7-24. [2] ib. (35-6), 16-1-24. [3] ib. (75), 14-7-24. [4] apprentice surveyor with Grant to Burma; DDn. 220 (133), 3-1-26. [5] SGO. SP (1). [6] had a wife and 3 children in Sept. 1826: entertained at Madras 10-2-29. [7] left Delhi Sept. 1827; acted in ch. drawing office till appd. HD., 24-8-28, @ St. Rs. 323 p.m.

which are written in the most plain and clear manner ; but the journals of the Surveyors contain a multitude of figures, symbols, terms of science, and...names, which the native scribes certainly do copy very incorrectly. ... The monthly field books alone of a single surveyor... often consist of 40 or 50 pages of foolscap closely written [and] will take up the time of the idle copyists in Calcutta perhaps for a month, and after all be ill done, and require much examination and probably recopying. ...

Instead of extra writers of a better order being added to...my office, it would...greatly contribute to correctness and expedition, if each surveyor...were allowed an expert writer...in his harassing duties. ... 100 Sa Rs. per month could not be thought too much. ... With the assistance of a writer, the surveyor might make his field books and memoirs in duplicate, one copy to be sent to England, and one lodged in the Surveyor General's Office. ...

No class of people make so small a return for their wages as the writers in Calcutta, ... owing to their natural idleness, the few hours they attend at the offices, their frequent real or pretended sickness, the interruption caused by numerous holidays, and other causes[1].

In April 1829 J. Dias was appointed to act as Registrar on the death of Burke, followed by C. Morrison from 14th January 1830. The draughtsmen now employed under Graham were Breton, W. H. Scott[2], G. H. McReady, C. K. Hudson, Khadum Ali, and Roop Chand, all names found on the beautiful maps of this period.

REVENUE SURVEYOR GENERAL

On taking up duty as Revenue Surveyor General, Hodgson obtained a generous office establishment which included, besides 15 apprentice surveyors and their instructor William Scott, a Registrar in the person of Marcellus Burke [II, 351 ; III, 306, 312], and "draftsmen and writers, or copyists", also

1 Accountant, or Native Register	Rs. 50 or 60	1 Frash[3]		5-8
1 Dufteree and Mate	12	2 Mihturs, or Sweepers, 4 each		8
6 Hircarrahs @ Rs. 5 each	30	2 Bhisties @ 5 each		10
1 Tindal	8	1 Mistry, carpenter, and mate		16
6 Lascars @ Rs. 5-8 each	32-8			
			Total Sicca Rupees	182

The Accountant...should be a trustworthy person, who can give security, and can keep the accounts of the office establishment[4]. ...

The Lascars are required during the instruction of the young men in the field, and for other miscellaneous services ; a frash, sweepers, and bhisties, are requisite to preserve cleanliness and health where there is a considerable number of Christians employed. The services of a Carpenter are continually required for making and repairing signal flags and coarser instruments, and repairing office furniture. The expenses of such office furniture...as is absolutely necessary may be most conveniently charged on a separate contingent bill[5].

In 1826 Burke was recommended for promotion to salary of Rs. 250 p.m. ; he had "respectably, industriously, and skilfully served in the Survey Department 20 years, having been apprenticed on the 1st March 1806" ; his salary of Rs. 151 and 2 annas a month "is a small sum to enable him to support himself and family"[6].

When the office was brought back from Fatehgarh [306], Hodgson sent all the apprentices out to field surveys except four ;

William Nix James [188 n.8, 190 n.2], Edward Winston, William Chill, and Charles Hyde Burke, ... senior apprentices, ... I brought down with me. ... Their salary is 60 rupees a month, which was sufficient at Futtehgurh, where they could live at less expense than in this Capital, and where I generally afforded them lodging on my own premises, but in Calcutta I cannot give them this advantage, and the charges for house rent, dearness of provisions, and conveyance to the office, straighten their circumstances and distress them. ...

I...ask...that I should...rent a small two-storied house, ... which very closely adjoins to my own, in which I could lodge these 4 young men, and where they would be...immediately under my own eye. ... In the lower story...I could also deposit some of the more bulky instruments, as a large supply...has arrived from England, and is now in the Fort, but they will occupy

[1] DDn. 231 (61-3), 16-11-27. [2] Wm. Henry Scott, b. Sept. 1812 ; appd. dmn. & writer 1-3-27; CD. 1-6-58. [3] office attendant. [4] Alexander Botello, appd. 23-10-23 ; drew Rs. 60 as acct. plus Rs. 60 as writer. [5] from Hodgson, 4-11-23 ; BTC. 20-11-23 (49-50). [6] ib. 26-4-26 (43).

so much space in my office, already overcrowded by the addition of the Revenue Survey establishment, ... that I shall have difficulty in finding room for them.

The rent of the house is Rs. 150 per month[1].

MADRAS ; RIDDELL, 1817–8

In obtaining approval to the establishment of an office in Madras subject to the Surveyor General, instead of transferring the records to the Chief Engineer [291, 316], Mackenzie emphasized the multifarious duties involved ;

Constant requisition for information of a territory embracing 1,66,125 square miles...—frequent attention...to...boundaries...—communications and orders to the surveys carried on in this Presidency. ... These...can only be carried on by a regular series of Instructions, of orders, of reports, periodically, monthly, or quarterly. The progress of the surveys [I, 283 n.8] ...in distant provinces is a constant subject of solicitude ; in varying climates, they are to be directed, watched, encouraged, or checked, as occasion may require. ...

An establishment of 29 native surveyors [I, 283 n.8]...occupy much of the time...—Necessary orders and explanations on...their professional duties...—Regulation of their pay and allowances. ... The employment of a small well-arranged establishment...instructed in the elements and practice of drawing and surveying, would be equally useful in all the presidencies, ... and...the employment of a certain portion of these young men...by transfer to the other presidencies might relieve this. ...

I would propose...that the depot of Charts and Surveys, ... with the exception of those ...to be transferred, be retained as an immediate appendage to the offices of Government, under the charge of an Assistant to the Surveyor General of India, ... appointed for that purpose. ...

That all orders and communications of Government...be made to the Surveyor General of India, but such as require early or immediate attention be communicated thro' this office as a regular channel of communication to the surveyors. ...

That the Assistant in the Surveyor General's Office at Madras submit to Government periodically...the state and progress of the surveys, receiving for that purpose the reports of the Surveyors, retaining duplicates, and transmitting the originals to the Surveyor General of India with his observations thereon. Quarterly accounts of the expense of the surveying department as usual to be sent in to Government and to the Surveyor General. ...

A report of the progress and conclusion of surveys will be made up from the Surveyors' reports by the Assistant in the Surveyor General's Office, and submitted to Government periodically, and the maps, memoirs, journals, and field books...&c., will be transmitted...to the Surveyor General's Office at Calcutta. ... A moderate establishment for this office will be employed in copying such documents as are immediately ordered by Government, or required for the Surveyor General's Office, and regular reports and returns...will be transmitted to the Surveyor General of India at Calcutta.

All Surveyors employed on survey under this Presidency to address their letters and reports to the Surveyor General's Office at Madras. ...

The following establishment is proposed ; ... An Officer Assistant, in charge of the depot and office of the Surveyor General of India per month (exclusive of batta) pagodas 70—One draftsman, not to exceed per month ps. 25—one writer, not to exceed per month ps. 15—... One Assistant Surveyor (William Lantwar) who has been instructed for this purpose. He will be necessary for some time at least to assist the Officer in Charge till he has acquired sufficient knowledge of the contents of the depot and office[2]. ...

Any native Assistant Surveyor that may come to the Presidency...will be...employed in the drawing and writing department ; ... the attendance of one of them...may be considered permanent. All the Assistant Surveyors being already sent, or about to be sent, to the surveys in the country, with the exception of the two above-mentioned, and one lately arrived sick, the same room...will be no longer requisite for the establishment, ... which will seldom exceed six.

But the materials proposed to be transferred will still require scarcely less room than before ; for the almiras[3] and their contents will gradually increase from the materials coming in from the survey. The quantity of instruments...will also increase considerably. ... On

[1] 36 Park St. ; BTC. 24–8–26 (44). [2] unfortunately Lantwar died, 28–5–17. [3] cupboards [310].

these accounts a convenient house...would be desirable, ... but a fixed commodious office in Fort St. George near to the Government House would be much more...convenient. ...

I must deprecate the further removal of what may be considered a very valuable collection, that has cost...very considerable sums, until a commodious place is secured permanently; ... the repeated removal of these charts has considerably added to that injury they have sustained from various modes of keeping. ...

A previous knowledge of the practical application of the [survey] principles in this country, as well as of official details, is still more essential. ... In the distance from...Calcutta, frequent occasions will occur where the assistant's own knowledge will be...referred to. ... An officer already acquainted with the practice of geographical surveys in India would be more usefully appointed...under the direction of the Surveyor General, but subject in every respect to the control and orders of this Government. If a knowledge of...conducting and calculating trigonometrical operations...is added, ... it will be still more useful.

He suggested John Riddell as possessing these qualifications to the full [II, 439], and asked for his early appointment. This was referred to Bengal and, though the Supreme Government was reluctant to depart from the definite order to deposit the records with the Chief Engineer [315], they agreed that

the literal execution of the Hon'ble Court's orders, by compelling the delivery of many valuable records...to the custody of a department usually overburdened by its proper functions, and by vesting...the superintendence...of survey duty...in an officer wholly distinct in his powers, and independent of the Surveyor General, ... may tend to defeat the projected unity of effort and concentration of geographical and statistical information—

The Surveyor General should take with him all records required in Bengal—

The remaining records...should be transferred to an officer who shall be left in charge provisionally of the branch of the Survey Department which will remain at Fort St. George until the expediency...of permanently establishing a subordinate survey branch under that Presidency shall be finally determined. This officer...will...discharge all such duties under the orders of the...Governor in Council as have hitherto been conducted by Colonel Mackenzie.

In...the choice of the individual to fill this temporary office, ... every attention should be paid to the recommendation of an officer so distinguished for public spirit and eminent talents as the present Surveyor General of India[1].

After earnest persuasion, and after the Commander-in-Chief, General Hislop, had specially inspected the office, Riddell's appointment was sanctioned[2]. He joined on 16th June and took over on 18th July on Mackenzie's departure for Bengal[3]. The office staff on June 1st comprised;

4 Draughtsmen :—Christian Andreas Ignatio; John Newman; John Mustie, and John Gould, the two latter being apprenticed to Mackenzie[4].

4 Writers :—Lucius Rawdon Burke, Head Writer; ... Anthony Rodrigues and Domingo Ferrier, copyists; and Henry Hamilton, assistant surveyor [312], employed as extra writer.

Mackenzie took all of these to Bengal except Ignatio and the two copyists. On Newman's death [312] he thought of calling Ignatio to Calcutta, but decided against it, writing to Mountford;

Be so good as to give some douceur to Ignatio for the drawings[5], and send me the whole round by sea, finished or not, as I can get them done here.

I some time ago enquired of Ignatio whether he would like to come here in the vacancy made by Newman, *provided your office could spare him*. He first declined it, then lately offers to come, but with so many conditions implied that I do not much relish having anything to say to him, and at all events not without your express permission. ... I could get him the same salary as Newman had, but I am really apprehensive that he would ultimately hang heavy on our hands, as I know he was involved at one time.

I enclose you his letter · *in confidence*. I do not much like it, nor his ignorant coarseness in mentioning his complaints, which would require *the Scott's remedy of a scrubbing post*. As senior draftsman he had the first choice of coming round, but he foolishly declined it, and poor Newman accepted. Pay Ignatio what you like as a gratuity, tho' in my time I made them do these things in the office as an improvement to their qualifications[6].

Riddell's appointment brought a protest from Garling against the use of the title "Assistant Surveyor General" by an officer who was his junior. Mackenzie

[1] DDn. 142 (91), 16-5-17. [2] MMC. 19-6-17 (29-31). [3] DDn. 151 (12), 16-6-17; MMC. 19-6- & 26-7-17. [4] Edward Jervis, dmn., drew fair copies of maps, 1817-18. [5] for the collections. [6] DDn. 149 (51), 23-3-19.

pointed out that whilst Riddell was acting on a

temporary salary of 70 pagodas per month in a very responsible charge at Fort St. George, Lieutenant Garling holds the more advantageous situation of a Surveyor, on a salary of pagodas 150 per month [350]. Had Lieutenant Garling been selected for this situation, ... he might justly complain of being put into a more expensive situation on diminished allowances[1].

To Riddell himself he writes ;

I am sorry that this gentleman every day seems studiously to increase the perplexity which, however, must be removed. ... Remember, that you are the organ of Government; that it is their orders and those of the Surveyor General you communicate[2].

The Supreme Government ruled that Riddell's official designation should be "Assistant in the Surveyor General's Department" and Garling was at length pacified. He had given Riddell an opportunity to be amusing, having

varied about thro' all the changes he could ring. At first it was "Lieut. R., in provisional charge of the Surveyor General's Department", and then "Lieut. R., of the S.G.'s Office", and now it is "Lieut. R., in charge of Office, Surveyor General's Department"[3].

The field surveyors took to using unauthorized designations for themselves, such as "Surveyor in Travancore", or "Assistant Surveyor General", the latter a title officially reserved for officers in the Presidency offices. The correct designation of the officer in charge of a field survey unit was, writes Mackenzie, "Surveyor, in charge of the——Survey"[4].

Altho' it is of no great consequence, yet it is proper in giving the names of the surveyors in the Almanac that the actual situation and designation should be correct. ... The gentlemen on survey were recommended by me to be sent out as Surveyors in charge of different parties. Their now describing themselves as Assistants is by no authority. Major Williams of Bombay might just as well subscribe himself Surveyor General because he was actually such before May 1815, and an older Surveyor General than I was[5].

Mackenzie and Riddell, exchanged letters, both public and private, almost every week. Regarding office accomodation Riddell writes ;

I expect to leave your house about the 1st [August]. There is certainly no good one to be got for 20 pagodas, but I must do my best. The Government has no idea of giving more than is necessary, and Mr. Shore told me that he must stop the allowance (above 20) from the day of your departure. ... Since my last letter of 3rd instant nothing particular has occurred. The Depot is moved to the house formerly occupied by you in Vepery [II, 303-4, 421], which I have been obliged to take for six months, with...two months notice[6].

Mackenzie was most punctilious about correspondence ;

I wrote you from Sagur, or Kedgeree rather, a hurried scrawl of 24th July on our first arrival in the river ; I could not again write till the 18th ulto., when I addressed you a letter, marked No. 2, by post. This will be No. 3, & I propose afterwards to number my letters in succession as I observe you also mean to do ; it is an excellent plan, by which we will immediately observe if any misses[7].

Avoid shewing the official correspondence, or any other documents to any person whatever. Make it a rule to receive your friends in your sitting room, clear of office documents. I have myself experienced much inconvenience from not adverting to this[8].

You have made a mistake lately in referring in one of your public letters to a demi-official letter. ... Remember there is no such thing as a demi-official letter recognized in the Service ; let all your referable letters be official & entered as such. I again recommend to you to avoid writing on duty matters in private letters, as they may occasion mistakes.

Your letter to Lieut. Garling of 18th July was perfectly correct in its substance, only you should not have addressed him 'My dear Garling' if it was official, & if it was private you should not have signed it officially. ... Excuse me for putting you to rights[9].

Riddell describes his first rather awkward interview with the Governor ;

On the Monday after you left us, I thought it proper to wait on the Governor, and report that I had taken charge of the Department. He received me most graciously, told me that orders from Home had left him no choice, that they were positive in favour of the Engineer officers, & those only, being employed on survey [283-4, 330, 340], and that he had thought it his duty to oppose me on that ground.

He told me that I was entirely under the Bengal Government, & asked me if he had any

[1] from SG. 25-4-18 ; MMC. 16-6-18. [2] DDn. 156 (342), 24-4-18. [3] DDn. 151 (85), 24-12-17. [4] DDn. 149 (51), 23-3-19 (68), 8-6-19. [5] ib. (97), 26-11-19. [6] ib. 16-8-17. [7] DDn. 156 (295), No. 4, 5-9-17. [8] ib. (304), 23-11-17. [9] ib. (319), 22-1-18.

authority over me, & if he could demand plans, &c., from the Depot. I could only bow, and say most certainly. ... He then enquired into the strength of the establishment, ... and, on being informed, remarked its smallness. I stated that it was conformable to the orders from England, in the event of a transfer to the Engineer's Office. He replied 'But we should then have had the use of their draftsmen, &c. '. So you see he does not appear at all unacquainted with the arguments on that side of the question.

In answer to him I mentioned that maps of most parts of the country had already been supplied to the various authorities to whom they could be of use ; that a good map had lately been published by the authority of the Directors at home,[1] and that of more particular plans they seemed to wish to prevent the circulation [274, 289–90]. ... So we parted.

It was not long, before he was on close terms with all the secretariat ;

I am happy to hear that the Public Department is again to be the channel of our correspondence [303]. I am sometimes out of all patience with Mr. Wood[2] but, as his dilatoriness is very impartially extended to all, have no particular right to complain.

MOUNTFORD, 1818–22

To Mackenzie's great distress Riddell died on 1st September 1818, and at the suggestion of the Chief Engineer Mountford was brought down from Guntūr to relieve him, taking over charge on 25th [96][3]. Mackenzie welcomed his appointment, though he had hesitated to press for it. He writes to the Chief Secretary ;

I took the liberty of mentioning your name as not unfriendly...and I mentioned my reasons for hesitating on recommending any individual, after the obstruction I met in the case of that excellent young man, Mr. Riddell. I have great confidence in Mr. Mountford's capacity, zeal, and honourable principles, as qualifying him for that charge until a permanent appointment is made. But, as I do not know whether any notice of my approbation would be advantageous to him, ... make use of my name as you think most expedient[4].

To Mountford he wrote that it was the business of the

Government of Fort St. George to appoint an officer to...a duty belonging to that Presidency. ... Attend with patience the determination of Government ; you cannot suffer at any rate by being called up. Write me often of every step, and I will...inform you of every point necessary for your guidance...as I did poor regretted Riddell.

You should call on Mr. Strachey[5] with my compliments, as a friend of Captain Troyer's [II, 447–8] ; he will give you every reasonable support. ... Write to me often, ... very fully, and...observe your usual discretion till matters are adjusted[6].

Mountford's appointment was confirmed by the Governor General in a letter dated 18th October, and Mackenzie writes wishing him

joy of your appointment, and may you enjoy more satisfaction of it than some others have had. ... Take care of my old servants in and about the office ; there are not many of them now. Kisnajee you will find a very useful, valuable, man [II, pl. 22] ; Riddell found him so. ... Write me often. What is become of Captain Troyer ? recommend me to him [338][7]. ...

You are...the organ of Government, for receiving their orders and communicating them to the surveyors, to this office, and to other Departments, and you will refrain from issuing any orders of your own unless directed to do so. That excellent young man Riddell gave me great satisfaction. I had occasion in a few instances to put him to rights, but he always received my sentiments with the greatest good humour, and conformed as soon as possible. ...

Mr. Garling has expressed much dissatisfaction at Mr. Riddell's being in the office over him, but the opinion of every official and military man I have consulted is adverse to his idea that seniority in the Military Institution, or any Corps or other Establishment, gives any claim to appointment in an Office, when the incumbent is the selected organ of Government for communicating their instructions [317]. This is for yourself, as my sentiments have been so little acceptable to Mr. Garling, that I do not wish to trouble him further. ...

Be very guarded in your correspondence...on official matters ; indeed the best way is to avoid altogether any private correspondence. ... Your official duty...is entirely confidential ; the books, letters, etc., are not to be shewn to any person. ... I take the liberty of recommending your...excluding from your office and drawing room all visitors [317].

[1] Arrowsmith's [287], DDn. 151 (5–12), 24–7–17. [2] Edward Wood, MCS. ; Paymaster, 1815 Sec. to Govt. Mil. Dept. 1817 ; Ch. Sec. from 1820 ; d. 1824. DDn. 151 (139–47), 18–2–18. [3] John George Proby., Adjt. of Engrs. held ch. during interval ; MMC. 29–9–18. [4] DDn. 154 (37), 25–9–18. [5] Geo. Strachey (1776–1849) Ch. Sec from 1813. [6] DDn. 149 (5–6), 6–10–18. [7] ib. (6), 14–10–18.

There is one apprentice still of mine with you, Ch. Ignatio [318] ; ... get what money is necessary from Messrs. Binny. ... John Newman, the draughtsman, was sent round on medical certificate, and I have drawn his pay here till the day of his death. ...

The office at Madras is not designed to compile maps, which is the proper object of this office. It is merely as a depot and an organ of communication. ... If you once embark in ...compiling maps at private requisitions you will find yourself embarrassed [276–8]. Your road is clear ; Obey an order of Government, and communicate that order directly to the Surveyor General. ... When you...once...master...the correspondence, you will see...it is all plain sailing. ... I never wish to hurry any person ; I wish I could say the same of others[1].

It was not my fault that Mr. Riddell had not particular instructions officially on every point, but I was urged off in such a manner that it was only practicable...to shew...what was possible of all the vast materials, and leave the rest to future correspondence. I recommended to him the perusal of the correspondence, but...the whole of the duplicates were not ready when I left Madras, and have been only sent since. You have now the benefit of that, and I can only recommend to you to sit down tranquilly and peruse the correspondence from the beginning in November 1810 till the present day.

You will always recollect that the office at Madras is...at present temporary, ... and that nothing is to be done but by orders. It is not the duty of the Officer in charge to propose new surveys, or multiply duplicates of compilations, without he is called upon. ... Any applications from other departments are to be referred to Government and the Surveyor General. ...

All your official letters I will reply to one by one, never doubt. I have thought of setting apart two days in the week to Madras official duty, but at present I cannot attempt it from the heavy pressure here [303–4][2].

Mackenzie's heart was still with Madras, and his letters are full of enquiries on all sorts of small matters regarding maps and surveys, and old servants ; no matter appeared too small to engage his attention, and, in spite of occasional complaints of things not going exactly as he wished, he maintained the friendliest relations with all Madras officials. He tells Mountford to consult

Messrs. Strachey & Hill, whose judgement I never found to err, nor their kindness nor good offices wanting, excepting where press of business prevented, which...is the only reason for your not often hearing from me. ... Write me often, Mountford ; I wish to know how all my friends are going on ; I always remember my Madras friends with pleasure[3].

He makes repeated references to his ill-health, and to being overworked [304] ;

I have been under such a continual pressure for some time that it has been very heavy upon me, but while my health keeps up I have less reason to complain. All my correspondents have the same reason as you to feel the want of reply which is certainly not my fault[4].

This has been in hand three days, as I am kept in a hurry at this season of despatch. ... Don't blame me for silence ; I am really so harrassed that I have not a minute's rest, and I wish rather to go into the Madras business thoroughly, but this cannot be done shortly, and all instructions must be submitted to Government[5].

This instant I have yours of 18th ultimo...and all preceding are also come. There are heaps due to you, but all business has been suspended on account of one which has occupied me these 8 weeks upstairs, and I find it necessary to state to Government the arrears increasing in consequence of my being overloaded with references on matters that belong rather to the office of accounts, which I beg to be relieved from[6] [304].

You are merely the organ of official communication, and ought not...to make propositions that may possibly [disagree] with what has been, or may be, intended by the superior authorities. You should avoid all controversies with any individuals, and refer them to the supreme authority. The Collectors have no business to correspond with you but thro' the Board of Revenue, and Major De Havilland being put in communication with you, excepting thro' the Board, I consider an error [277–8][7].

You should at the end of the year begin a new No., and you will recollect that copies of all letters to and from Government, as well as other Departments, should be transmitted to the Surveyor General at the same time officially[8]. ...

Puri. My health...does not permit of that close attendance to the desk as formerly. Last night, however, I have (thank Heaven) got over one job that has long given me uneasiness ; that is the quarterly accounts, which were interrupted at the time I left Madras. ... For a *long, long,* time, I could not...bring them up for want of vouchers and documents and, after these

[1] DDn. 149 (9–19), 7–11–18. [2] ib. (27–34), 2–1–19. [3] ib. (27), 16–1–19. [4] ib. (9–18), 7–11–18. [5] ib. (27, 37), 15 & 27–1–19. [6] ib. (75), 4–7–19. [7] DDn. 154 (109) 6–2–20. [8] DDn. 149 (127) 14–6–20.

were obtained, the load of business in the office prevented my going into them[1].

It was one of Mountford's duties to submit quarterly returns of expenditure, and the following is the bill, September 1821, for the whole survey establishment.

Lieut. F. Mountford. Assistant Surveyor General, salary, Rs. 350; half batta, 65–10; office rent, 175 ... ... Total, Rs.	590–10–0
C. Ignatio, Head Draughtsman	87– 8–0
A. Rodrigues, Writer	35– 0–0
D. Ferrier, Writer	17– 8–0
Permanent Office Contingent	56– 4–0
Total expence of the Surveyor General's Office and Depot	786–14– 0
Lieut. B. S. Ward, *on survey in Coimbatoor*, salary, Rs. 350; half batta, 65–10; lascars' allowance, 70–6–3	485–00–3
Assistant Surveyors	
William Keyes, salary, Rs. 122–8; lascars' allowance, 28–14–11; horse allowance, 15–12; tent allowance, 24–8	191–10–11
Charles MacMahon, salary, Rs. 87–9; etc.	156–10–11
Total expence of the Coimbatoor Survey	833–06–01
Lieut. C. Snell, *on survey in the Northern Circars*, salary, Rs. 350; etc., as for Ward	485–00–03
Assistant Surveyors	
Michael Dunigan, salary, Rs. 122–8; etc.	191–10–11
John Faulkner, „ Rs. 122–8; etc.	191–10–11
Thomas Anderson, „ as for MacMahon	156–10–11
Charles Barnett, „ Rs. 56; lascars' allowance, 26–4–7; etc. ...	122– 8–07
Total expence of the Survey in the Northern Circars	1147–09–07
Capt. R. Young, *on survey in Hyderabad*	485–00–30
Assistant Surveyors	
Thomas Hill	191–10–11
Richard Long	156–10–11
Richard Ficker	156–10–11
Andrew Chamarett	156–10–11
Total expence of the Hyderabad Survey	1146–11–11
Asst. Surveyor T. Turnbull, *collecting historical information in Tinnevelly*, [III n.1] salary, Rs. 157–8–0, etc.	261–10–11
GRAND TOTAL, Madras ... Rs.	4176–04–06

MOUNTFORD & MONTGOMERIE, 1823–30

In March 1823 Mountford asked that his status should be raised to that of Deputy Surveyor General, and his salary increased to correspond;

Being in charge of this office and depot, and the channel of communication between the surveyors, yourself, and the Government, ... a greater...responsibility seems to be implied than is attached to any officer at this Presidency under the designation of "Assistant". ... The Deputies in the principal offices, ... their immediate principals being on the spot, ... have none of that responsibility which attaches to me, nor are any of them in direct communication with the Government[2].

Hodgson's recommendation to upgrade both Mountford at Madras and Sutherland at Bombay was accepted[3];

The staff salary allowed to Capt. Mountford appears to be inadequate to his merits, and to support the respectability of the situation he holds as the immediate head of the Survey Department at Madras[4], when it is considered that it is only Rs. 350 a month, and 65–10 difference of batta[5], being less than that of Captain Young, one of the surveyors under him in the Nizam's Dominions, who has 525 rupees and 65–10 difference of batta, and only equal to that of the other surveyors under his orders. ...

On the Bombay Establishment the staff salary of Major Sutherland, the Assistant Surveyor General, is 500 rupees per month, and the difference of batta of his rank 225 Rs. As the duties of Major Sutherland and Captain Mountford are similar, I...suggest the propriety of allowing to the latter officer the same staff allowance of 500 rupees a month[6].

About this time also Mountford obtained an increase of office establishment to cope with the ever-increasing demand for maps. He was able to recruit apprentice

[1] DDn. 149 (141–5) 23–9–20. [2] DDn. 200 (21–2), 13–3–23. [3] DDn. 197 (49), 18–4–23; confirmed under CD to M. 18–6–28 (64). [4] He was now senior to all the field surveyors. [5] being the ½ *batta* allowed to all soldiers in cantonments. [6] DDn. 126 (13–5), 29–3–23.

draughtsmen and surveyors, and brought Turnbull into the office to train them [110, 377]. In 1825 Montgomerie, who had succeeded on Mountford's death, engaged Joshua De Penning, who had resigned from the Great Trigonometrical Survey in 1824 [245, 326], and in January 1827 the establishment stood;

				Rs.
Lieutenant and Brevet Captain D. Montgomerie, Deputy Surveyor General			...	570–08
Thomas Turnbull, senior Assistant Surveyor and Instructor of the apprentices			...	157–08
J. De Penning, senior Assistant Surveyor, entertained [11–4–25] by order of Govt. 11th March 1825			...	113–12[1]
C. Ignatio	Head Draughtsman	122–8		
J. Gantz[2]	Draughtsman	87–8	[from 20–10–26 to 9–2–29]	
J. C. Joseph[3]	„	42–0	[from 1–5–23]	
J. Clamp	„	52–8	[from 20–10–26]	304–08
Mark Healy	Apprentice Draughtsman		[from 1–5–25] 21	
E. Rodrigues	„ „		... 21	
J. Summers[4]	„ „		[from 1–5–25] 21	
Wm. Ignatio	„ „		... 21	84– 0
3 Writers	...	...	... ...	73– 8
Permanent contingent and office rent			... ...	238– 4

At the end of 1825 the drawing office was reinforced from Hyderābād and Northern Circārs for two field seasons. Crisp took Hill to Calcutta Snell took long leave on medical certificate, and their assistant surveyors were brought in to Madras [118, 376–7]. When the surveys were resumed, Montgomerie asked that 12 apprentices may be immediately entertained...for the duties of Draftsmen and Surveyors. ... They become much more useful than if trained up merely as draftsmen, and a draftsman can hardly excel in delineating the features of the country unless he has practised in the field as a surveyor. ... I would recommend...the same allowance for cloathing and maintenance as heretofore, ... viz., 21 rupees each per mensem, and that the monthly sum of 35 rupees be also sanctioned to enable the instructor to afford them accomodation[5].

By September 1828 there were 14 apprentices under instruction [377], besides the office establishment of 6 draughtsmen, 1 apprentice and 3 writers, and in view of this increase, and other responsibilities, Montgomerie's staff pay was raised to Rs. 750 a month at the sacrifice of half-*batta*[6].

In February 1827, when Goldingham took furlough pending retirement, Montgomerie took charge of the Observatory, with an allowance of 100 *pagodas* a month, and moved the Survey office across to it. In October 1830 the new astronomer, Thomas Taylor [257 n.2], arrived from England, and Montgomerie withdrew "to a commodious house (Sullivan's Gardens)"[7].

BOMBAY, 1821–30

After his appointment as Surveyor General of India, Mackenzie's only contact with the Bombay Presidency was his correspondence with Elphinstone, Resident at Poona, regarding the survey of the Deccan [124]. He writes in October 1820;

The next Annual Report for 1819 & 20...will be submitted as soon as possible. Meantime, ... as no communication has yet been made from the Government of Bombay since the abolition of the Surveyor General's Office there, ... and no report of the Surveying Department of that Presidency has yet been...communicated to me, it seems desirable that measures should be taken for placing that Department...in communication with the Surveyor General, and perhaps for the...formation of an office for that purpose[8].

Disregarding revenue surveys, the Bombay Government replied that the only survey completed since 1815 was that of "the boundary of the Sattara Territories [171], which has been recently forwarded to Bengal", whilst "the Survey of the Deckan by Major Sutherland is yet in progress"[9]. They consulted Madras about the "Surveyors' establishment" maintained at that presidency, and at the same time invited comment from Williams who, since the abolition of the office of Surveyor

[1] raised to Rs. 157–8 in 1827, with pension 22½ *ps*. [2] previous service under CE.; recently returned from Penang. [3] probably Chas. Joseph, tr. 1833 to SGO. Calcutta, where he drew many important maps. [4] probably son of James Summers, appce. Survr. 1800 [II, 352]. [5] DDn. 222 (2), 12–1–27 [6] DDn. 237 (4), 30–12–28. [7] ib. (245), 20–10–30. [8] Bo MC. 26/1820 (2); 15–10–20. [9] Bo. Castle, 22–1–21.

General had continued to act as their survey adviser [279–80]. Williams welcomed the opportunity to ventilate his disgust at Hodgson's appointment as Surveyor General [300], which was even more bitter than his disappointment at Mackenzie's selection in 1815 [II, 457] ;

In January 1815 orders were received here...for abolishing the office of Surveyor General at the three Presidencies, and for the appointment of one Surveyor General of India, *open to selection from the Military Servants at the three Presidencies*. I had then been 8 years Surveyor General of this establishment, and I submitted...a claim to the new office. ... The answer to it was..."that His Lordship has decided on bestowing the appointment of Surveyor General on Colonel Mackenzie, of the Madras Engineers" [II, 306–7].

After what had thus passed, I never entertained a doubt (as Colonel Crawford...had returned to Europe) of...having the next claim to the situation, ... and I continued with unabated zeal...to pursue the improvements in the general geography of India. ...

These pursuits were, of course, greatly interrupted by the duties of the Revenue Branch, ... on which Government had been pleased to employ me. Still, I cannot but feel proud of having just brought to a completion...a General Map of India on a scale of 9 inches to a degree [280] ; a work which has not disappointed the Government here. ...

Information unexpectedly reached Bombay...of the death of Colonel Mackenzie. ... I felt very confident that I should not be overlooked. ... The latest intelligence from Calcutta, however, announces the appointment of Captain J. A. Hodgson. ... I only ask that the degree of my disappointment...may be...deemed...a sufficient reason for the alteration of my intention of going round to Calcutta. In the meantime...the General Map of Hindustan is entirely ready for transmission to Bengal [I, 219 ; II, 248–5 ; III, 280]. ...

The establishment as well as pay of Surveyor General ceased on the 1st March 1815. ... All the expenses of carrying on the duties...remained upon me. The final preparation of the great map alone has cost a good deal of money, as well as the preparation of many other papers of magnitude and importance...during the last 5 or 6 years. Although I have...derived considerable assistance from the Revenue Survey office, yet there have been...additional charges of various descriptions, of which I am sure the Honourable the Governor in Council will... sanction the reimbursement. ... They must have at least amounted on an average to 80 rupees per month, from the time the Surveyor General's establishment was stopped[1].

The Governor, Mountstuart Elphinstone, noted that

Major Williams has...been referred to...on all subjects connected with geography, and has afforded it exactly as if he was still Surveyor General. I have...no hesitation in agreeing to the allowances he requires, but I think he is likewise entitled to a personal allowance for performing duties entirely unconnected with the Revenue Surveying.

The arrangement which abolished the office of Surveyor General of Bombay must restrict us to the remuneration suitable for an Assistant or Deputy Surveyor General, an office we ought long ago to have formed, and without which we could not...have gone on, had not Major Williams gratuitously performed the duties. As Major Williams...was formerly Surveyor General, he might not be pleased to be now paid as an assistant. We might grant him, ... in addition to the 80 rupees for establishment, a sum equal to the pay of the Assistant Surveyor General at Madras[2].

Though Williams was now told that a special extra allowance of Rs. 700 a month had been applied for, he still pressed the injustice of Hodgson's appointment, and submitted a memorial asking that he might be appointed "Principal of the Survey Department" in Bombay. This the Bombay Government agreed to forward, but pointed out that the choice between candidates was a question on which

the Governor General alone is...qualified to decide. With regard to the appointment you have suggested, the manner in which the Survey Department at this Presidency is hereafter to be constituted forms at present a subject of reference to the Supreme Government. If, however, ... arrangements should present any situation...suitable to an office of your rank and merits, the Governor in Council will have much satisfaction in appointing you to it[3].

Williams refused to be reconciled, and in November his resignation was accepted. He went on furlough shortly after 19th November 1821, handing over all survey duties to Cruikshank [170–1]. It was not until February 1823 that the Directors authorized Rs. 200 a month in addition to his other allowances from the date of abolition of his post as Surveyor General[4] [351].

[1] from Williams, 24–6–21. [2] Bo MC. 26/1820 (109–10), 5–7–21. [3] ib. 9–8–21. [4] CD to Bo. 26–2–23 (2).

From 1st May 1822 Sutherland was appointed Assistant Surveyor General[1], with his office as depot for

of every species of geographical information, and officers in charge of surveys to receive their instructions through him. Monthly communication of the progress of each survey, together with the work proposed...during the ensuing month, to be made to the Assistant Surveyor General, who will submit to Government frequent reports on the state of the surveys. ...

Officers in charge of surveys to be left uncontrolled on all matters of detail or the manner of executing their instructions [*inf*].

The Assistant Surveyor General to take under his particular congizance all routes or surveys carried on with troops moving through districts imperfectly known, and to be careful in preserving...documents which are to be transmitted to his office. ...

The Assistant Surveyor General to correspond direct with the Surveyor General of India ...but any change directed by the Surveyor General is to be communicated to the Government before it is carried into effect.

The Revenue Surveyors will furnish any geographical information they may possess when called upon, but...they are...to be independent of the Assistant Surveyor General[2].

Sutherland's appointment was warmly welcomed by Hodgson[3]. Handing over charge of the Deccan survey to Jopp, he made Poona his headquarters. His small office staff included the experienced draughtsmen Webbe and Sundt who had worked under Malcolm and Williams [281], and were now transferred from the Gujarāt revenue survey together with all the geographical maps and papers that Cruikshank could disentangle. The transfer was completed by November 1822[4].

Sutherland was upgraded to be Deputy Surveyor General[5] in May 1823 [320] but protested that his salary remained the same as when in charge of the Deccan survey, though his responsibilities had been much increased.

It was still a long time before there was any close co-operation between Bombay and the Surveyor General, and in May 1824 Blacker expressed disappointment at the scantiness of the information provided in Sutherland's reports, and asked the

reason which induced the establishment of your head quarters at Poonah instead of the Presidency. ... I cannot discover why an arrangement, which at Bengal and the Coast [193 n.2] is indispensable to the...duties of the department, should be unnecessary at Bombay[6].

Again in June 1825 ;

On the 29th January last I called, among other documents, for certain reports, ... and being still on the 26th March last without a reply, I on that date transmitted to you a duplicate of my former letter. Although I have since been favoured with two several reports, ... you have omitted to notice the particular information I demanded. ... I...repeat my former orders...that you will...transmit methodized lists...accounting...for the delay, which has imposed on me the task of frequently repeating the same instructions[7].

In February 1826 Sutherland took furlough, having spent 24 out of his 28 years service on survey. Jopp succeeded him, and still retained headquarters at Poona. On Hodgson's protest against his signing himself "Deputy Surveyor General of India", he pressed, without success, for improved status ;

I do not possess the advantages enjoyed by Deputies of other Departments, of holding charge of a superior station nor, in the absence of Principals, have I the prospect of succession to a superior grade. ... Although nominally only a Deputy, I am virtually at the head of a Department at this Presidency...in the situation of a Deputy in Charge. ... Although promoted ...from Superintending Surveyor of a Province to the higher official situation of Deputy Surveyor General of India, such promotion has not been attended with any increase of allowances[8].

In 1827 Hodgson called attention to the instructions under which Jopp was

precluded from directing the officers under your superintendence in matters of detail. ... As those expressions are evidently inconsistent with the superintending power delegated...by the same order, ... it...appears to me to be...proper that the Deputy Surveyor General, who is responsible to the Government, should have the power of...controuling...the surveyors under him in all matters which he deems conducive to the good of the service. ... I request you will bring the subject to the notice of the Honourable the Governor in Council[9] [*sup*].

[1] Bo GO. 1-5-22. [2] Bo MC. (Camp), 59/1822 ; 25-3-22. [3] DDn. 196 (224), 30-5-22. [4] Bo RC. 98/1823 (196), 12-11-22. [5] ib., 12-5-23. [6] DDn. 220 (39). 18-5-24. [7] ib. (82), 7-6-25. [8] Bo MC. 189/1826 ; 30-11-26. [9] DDn. 220 (243), 20-7-27.

The establishment of the office on 31st October 1828 was as under[1];

Captain Jopp, Deputy Surveyor General; staff pay, Rs. 500; office rent, 150; writers, 130; harkaras, peons and lascars, 82; stationery, drawing materials, etc.	Rs.	1111
Mr. W. Webbe, Asst. Surveyor		450
Mr. W. Sundt " "		350
Draftsmen		800
TOTAL ...	Rs.	2711

Establishment of Writers, Harkarras, Peons and Lascars...

1 Writer	Rs. 80	2 Harkarras	@ 12 Rupees ...	Rs.	24
1 Writer	50	2 Peons	@ 10 "		20
	——	4 Lascars	@ 9½ "		38
	Rs. 130			Rs.	82

Establishment of Draftsmen, ... Government letter dated 12th May 1826 [281];

2 Draftsmen	@ 150 Rupees each	Rs.	300
2 "	@ 100 "		200
4 "	@ 75 "		300
		Rs.	800

GREAT TRIGONOMETRICAL SURVEY

From the time of Mackenzie's appointment as Surveyor General of Madras he had been responsible for reporting expenditure on all surveys, including Lambton's, and this was continued on his appointment as Surveyor General of India [307]. Lambton's expenditure for October 1815 was[2]

Salary, &c., of the Superintendent	Pagodas[3]	502–28–45
Lascars, Coolies...	"	136– 0– 0
Guard	"	77–35–40
4 Assistant Surveyors	"	213–15– 0
Total, besides extra Contingencies 77–18–66, ...	"	929–34–05

On transfer to the Supreme Government he was ordered to put forward recommendations regarding his establishment, who would now be serving outside their own presidency[4] [225–6, 379];

You will...address yourself without delay...thro'...the Public Department on all points of detail...relating to your people, establishment, papers, records, etc., which require the interposition of Government. ... You will also correspond...thro' the same channel, on all topics ...on which you have hitherto usually communicated with the Government of Fort St. George[5].

Lambton's first request was for improved pay for his three assistant surveyors, Peter Lawrence having been discharged at the end of 1817 [378–9], and for their number to be increased to six. He asked for an increase to his escort [228, 406], and there will be various contingent expences, ... many of which cannot be foreseen. ... The principal ones are those when the inhabitants are employed...in making roads and getting up the mountains, where sometimes I...employ three hundred; but by paying as many fanams I prevented the delay of...perhaps ten or fifteen days. ...

There are various other expences, such as...signal flags and flag staves; building permanent platforms; aid given and materials supplied when the base-lines are measured. ... The contingent account also includes the sepoys' clothing; stationery; new instrument boxes, or the repair of old ones, etc. But...I have had a full discretion to do what I thought was necessary, ... and...the Civil Auditor had orders to pass all accounts bearing my signature.

My supplies of cash have come from the Collectors, and sometimes from the Military Paymasters, when I was in the Company's Districts, and these gentlemen were directed...to furnish cash for bills on my private Agents [260 n.1], to whom I sent a draught on the Sub-Treasurer. ... Now that I am in the Nizam's country, I am supplied in the same manner by the Resident[6].

His return of expenses for January 1818, shewn in Madras rupees which were worth a little less than *sicca* rupees, was as under;

Salary to Lieut. Col. W. Lambton...	Madras Rupees	1400–00–00 [352]
Addition equal to the Company's allowance to a Major for half-batta, and tent allowance for 31 days	... ...	359–03–06
Allowances for the carriage of Instruments ...	... ...	301–00–00

[1] DDn. 234 (6), 1–3–29. [2] SG.'s 14–12–15; MPC. 12–1–16. [3] 80 *cash* 1 *fanam*; 42 *fanam* 1 *pagoda*; 1 *pagoda* from 3 to 4 *sonaut* rupees [II, 278 n.7]. [4] Mackenzie's staff had all had increases of pay on transfer to Bengal [373 n.2]. [5] from Sec. to GG. 25–10–17; DDn. 64 (69). [6] DDn. 63 (426), 27–11–17.

Pay of 1 Jemadar, including batta for 31 days	...	...	31-11-08
" 4 Havildars " " "	...	...	51-10-00
" 4 Naigs " " "	...	...	44-10-00
" 48 Sepoys " " "	...	...	451-08-00
" 24 Flag Coolies and 1 tappal peon[1] ...	...	...	175-00-00
Salary to J. De Penning	...	...	157-08-00
" J. Olliver	...	...	122-08-00
" W. Rossenrode	...	...	122-08-00
Horse allowance for three	...	...	47-04-00
Tent allowance for three	...	...	73-08-00
3 Lascars for J. De Penning	...	...	28-11-02
4 Lascars for J. Olliver & W. Rossenrode ...	...	...	38-04-02
Total Abstract, *Sicca* Rupees		...	3260-10-07[2]

Expenditure was increased at the end of 1818 by the arrival of Everest and Voysey [227-8, 353], and in October 1819 Lambton asked for his allowance for carriage of instruments to be increased so as to cover the many instruments he had acquired on his private account [257], and also for

two private or baggage tents for each instrument ; ... one for the guard, and one for the instrument and the...people who remain with it on the mountain. There is besides an observing tent...carried by three coolies. ... As these tents are built and carried at my expences I wish that something equivalent to the tent allowance for five tents may be granted.

I have for many years been using instruments for the public service which are my own property, and, which being of the highest order, have cost me considerable sums of money [II, 254]. ... With respect to the tents, I have never been in the habit of charging anything, even in the contingent account. The expence, however, becomes now so heavy that I venture to submit the circumstance to the consideration of Government[3].

Becoming impatient at receiving no reply about the pay of his assistants and the strength of his escort, he put in a strong reminder in August 1820 ;

As near three years have elapsed since my letter of the 28th November 1817 was submitted to the Surveyor General, without my having received any reply, ... and as...he is now on the sea-coast [18, 300], where he may remain for many months, I must beg leave once more to bring this subject to the notice of the Most Noble the Governor General in Council. ...

If the additional escort is not approved of, it may be reduced, and the old number remain, ... but the parties in the field must have guards from the line. The paragraphs regarding the contingent expences and supplies of cash were all complied with when I was at Calcutta [228]. As to orders to the public functionaries, it will be better that they be given when I am likely to stand in need of them. The same with respect to the Commissaries of Stores. So that nothing now remains...but...what relates to the Sub-Assistants [379][4].

Mackenzie still did nothing, but the matter was taken up by Hodgson directly he became Surveyor General [300]. He strongly supported Lambton's recommendations even though they added Rs. 672-15-1 p.m. to the expense of the survey ;

I coincide...on the expediency of augmenting the salaries of the three...assistants, and of adding three more to his establishment. To state my reasons...would only be to repeat those urged by Colonel Lambton. ... In such important...operations...the truest economy is to employ a sufficient number of assistants of the best talents, and to afford them liberal allowances. ... As to the increased number of assistants, it seems a public advantage that as many young men as may be useful should reap the benefit of the instruction they will...receive[5].

Hodgson's recommendations were accepted forthwith, and confirmed later by the Directors without the slightest demur[6], so the manner in which they were held up by Mackenzie appears the more unreasonable [304-5].

On Lambton's death Everest had difficulty in procuring cash for official payments, more especially as the Trigonometrical Survey had been transferred to the Military Department under the same orders as applied to the Surveyor General [31], who recommended that as the Superintendent has such a large establishment, and may occasionally have to detach some of his people at short notice, ... and...make disbursements for contingent expenses...which cannot always be foreseen, and when it is considered that his duties must frequently place him remote from the regular channels of payment, ... he may be authorized under pressing circumstances to receive advances, ... for...a considerable period must elapse ere the audited bills can be paid in the regular course of disbursement[7].

[1] post runner [I, 303 ; II, 334]. [2] DDn. 92 (72), 1-2-18. [3] DDn. 144 (389-92), 28-10-19. [4] DDn. 145 (385-9), 31-8-20. [5] DDn. 64 (93), 14-6-21. [6] CD to B. 29-10-23 (45). [7] DDn. 198 (101-2), 8-9-23.

The utmost extent to which Government would relax pre-audit was to promise that orders will be communicated...to insure adjustment of Captain Everest's abstracts monthly *on their presentation* to whatever Pay Officer he may be at any time most approximate, by draft payable at the nearest practicable point to which Captain Everest may approach. Under this arrangement an irregular mode of transacting business will be avoided, and...the wants of Captain Everest's department will be sufficiently provided for[1].

The establishment taken over by Everest was ;

Salary to Captain Geo. Everest, Superintendent ... *Sicca* Rupees	1300–00–00	
Allowance for carriage of instruments	364–00–00	
Pay of one Jemadar, one havildar, three naigues and thirty sepoys, with batta for 30 days	300–07–10	
Pay of 24 flag coolies and 1 tappal peon	162–08–00	
Allowance for 5 private or baggage tents	110–00–00	2236–15–10
Salary to H. W. Voysey, Esq., Surgeon, etc. ...	600–00–00	
„ a Dresser	40–00–00	640–00–00
„ Joshua De Penning, 1st Sub-Assistant	400–00–00	
„ Joseph Olliver 2nd „ „	250–00–00	
„ William Rossenrode 2nd „ „ [382]	250–00–00	
„ William Lambton 3rd „ „	107–00–00	
„ Joseph De Penning 3rd „ „	107–00–00	
„ Murray Torrick 3rd „ „	107–00–00	1221–00–00
Total *Sicca* Rupees		4097–15–10

Within twelve months he had lost the services of Voysey and Joshua De Penning [245], and young William Lambton [379] ; Joseph De Penning was discharged at the end of 1825 as unlikely to make a useful surveyor.

As he advanced northwards through the wild hills north of Berār [243–5], Everest had considerable difficulties about cash ;

The unusually large amount of the contingent account for last month requires, I think, some explanation. ... It has been necessary to move all the instruments and heavy apparatus ...above the Ghats to Hossungabad, where I have deposited them in a bungalow of my own, and as no regular charge is allowed for the carriage, ... I have been obliged to pay such price for cooly hire as the local authorities chose to fix. The transport...has been as cheap as I could...make it, but the expence is still heavy.

I...carry about...a large sum of money, frequently...4,000 rupees and upwards, ... at my own risk, and...advanced from my private funds. Still, it is a measure of absolute necessity in this desolate tract of country, and hence arises a monthly charge for coolee hire. ...

I transmitted my monthly bills to the Paymaster at Nagpur in March last, with the request that he would forward the amount in Nagpore rupees. ... In lieu he sent me a bill on the sub-treasurer at Fort William. This bill was cashed by the Paymaster at Ellichpoor in Nagpore rupees at a loss of 4 Rs. 6 annas 7 pies per cent, and, as I was then entering a tract of country where these rupees only were current, I was obliged to abide by the loss. ...

As the monthly abstract cannot be sent for payment before the termination of the month, I am obliged to advance the pay...as well as all contingent charges from my private funds. ... As it is impossible for me to violate the long-established custom...of paying up all arrears, I must continue to submit to the loss and inconvenience. ... It would, however, be of great service if a written authority...were...to enable...Mr. Olliver to draw the amount of the regular abstracts...in the event of my absence. Without such provision it is inconceivable what... confusion would take place in case any accident should occur to me[2].

The inability of "His Lordship in Council...to sanction any departure from the established rules" weighed very heavy on Everest, who pointed out that regulations were not devised for work in such inaccessible tracts, and that without

some indulgence in the settlement of my contingent accounts, the total ruin of my private affairs is inevitable. ... I have no hope of escaping...a perpetual correspondence, ... the evil of which I must deeply deplore, because every hour is of importance to me ; because to the performance of my professional duties an undivided attention and mind free from anxiety are indispensably necessary, and because it will be...impossible to liberate my office from arrears of calculation...unless...my present correspondence be considerably reduced. ...

I have never evinced any disinclination to use my own private funds in the public service, but...have almost always large sums advanced on the public account[3].

The difficulty was eventually met by the deputation of a special commissariat official to undertake all disbursements ;

[1] DDn. 197 (89), 17–10–23. [2] DDn. 171 (180–4), 11–4–24. [3] ib. (268–70), 17–8–24.

In 1824...the delay in passing my bills was such that I had upwards of 20,000 rupees of my own money advanced on the public account, and carried about in my writing desk authority from my agents on native bankers in all the large towns near my line of operations ...to the amount of 40,000 rupees. At length...orders were issued to the Pay Department to pay my monthly bills immediately on presentation at the nearest pay office, ... and a Commissariat Agent, provided with funds from his own department, was placed in attendance...to ...relieve me from all further concern with the contingent accounts[1] [415–6].

When Everest took furlough to Europe, he left under Olliver's charge

	Mr. Joseph Olliver, 1st Sub-Assistant ... ... *Sicca* Rs. ...	400–0–0
	„ Wm. Rossenrode 2nd „	300–0–0
	„ Murray Torrick 3rd „	140–0–0
	„ John Peyton 3rd „	107–0–0
1	Sirdar and 2 instrument coolies @ Rs. 7–2	219–8–0
12	principal flag-coolies @ Rs. 5	96–0–0
6	Hurkarahs @ Rs. 8	30–0–0
1	Jemadar, 1 havildar, 3 naiks and 30 sepoys	332–0–8
	Allowance for 4 private tents @ Rs. 22	88–0–0
1	Dresser	40–0–0
	Total Sa. Rupees ...	1752–8–8

Contingent expences...are paid by the Commissariat, and in order to preserve efficiency it is merely necessary that the native agent should be regularly supplied with cash to meet the current demands. ... Camels must be supplied by the Commissariat Department...viz.,—for the office tent 2 camels—for the medicine chests 2 camels—stationery and book boxes 1 camel—Total 5[2].

Olliver set out with his brief from the Surveyor General [261] ;

You will despatch your abstracts on the 1st of the month to the Paymaster at Benares, by whom will be remitted to you without delay the draft for the amount. ... If you have a sufficient escort in waiting at Saugor at the proper time, you will be able to disburse the pay of the establishment in a short period after it shall be due. ...

You will no doubt see the expediency of regulating your control over the establishment with such a mixture of firmness and kindness as shall attach all the individuals of it to the common object, and ensure the success of the survey. ...

Keep a regular acquittance roll, which will always bear witness to your integrity and fidelity.

You will pursue the example already set you by the Superintendent in your communication with the civil authorities and Commissariat; and your own good sense will direct...a tone of respect in all your addresses to officers of authority, whether civil or military[3].

He was from time to time disturbed by audit objections, as we all have been, and he appeals against a cut of Rs. 30 p.m. for rent of a house during the rains ;

Secure shelter is essentially necessary during the rainy season for the office, ... laying aside the urgent advantage of obtaining efficient medical aid by taking up monsoon quarters at a military station, as also the advantage offered in the magazine in the way of sundry repairs and improvements to the instruments, etc. ... If the department were to remain during the rains at some village, ... it would even then be necessary to erect a temporary sort of thatched roof sufficiently secured from boisterous weather, as well as from cold blasts and damp. ...

I have earnestly to solicit...some arrangement to free me from...retrenchment on actual expences. ... Independent of...office rent, objection is made on the sepoy clothing bill, and I am at a loss...to have that item arranged for. I have no competent authority to indent on any but the Commissariat Department for all items of contingent expences. ... Should... the charge for office rent [be] inadmissable, I must cheerfully submit to the decision and bear the loss, but...what would be expected of me in the way of having an office...during the monsoon[4] ?

Control of expenditure was so close that the Surveyor General had to apply to Government before he could authorize Olliver to engage 12 pack-bullocks for the carriage of consumable supplies through Rewah and Palamau, as they were extra to the seven camels authorized for Government property.

[1]DDn. 286 (C), 22–5–33. [2]DDn. 171 (412), 20–9–25. [3]DDn. 201 (173), 11–11–25. [4]DDn. 174 (36), 3–1–27.

CHAPTER XXIII

SURVEYORS

Bengal; *Topographical Surveyors — Revenue Surveyors — Quartermaster General's Officers* — Madras; *Military Institution — Quartermaster General's Officers — Surveyor General's Officers* — Trigonometrical Survey — Bombay — *Uniform.*

WITH but few exceptions all Bengal surveyors were withdrawn for military duty during the Nepāl War, and many of them did useful survey whilst on active service [II, 40–3, 90]. The majority of military surveyors came from the infantry for, though the Directors urged the employment of engineer officers who were given special survey training in England [II, 308–9; III, 317], these could seldom be spared, and Mackenzie deplores a shortage that compelled the employment of untrained officers on engineer duties;

If...employment...without the presumed necessary qualifications is sufficient, why keep up a Corps of Engineers at all? But if a body of officers, educated for the express purpose of conducting...works...of defence and of military architecture, is necessary, ... why should they not be in a sufficient number [II, 309; III, 330, 340]?[1]

He had only recently come up from Madras, and was shocked at the casual way that survey officers were appointed. Morrieson, for instance, was given a totally inexperienced assistant in the Sundarbans;

Captain MacGregor never has been employed on any survey in any way whatever. This is his first step in the line of an assistant. He has never been in the Sundarbunds in his life, which is one continued net of rivers. Were his first attempts to be made with a perambulator and compass on shore, it would be hard enough to drive him out at once without having seen a survey even on *terra firma*, but, when placed in a boat at the mercy of currents and winds, getting his rate by a piece of string—with the numberless difficulties—he is sure of mistakes. ... It would be...very unfair...his being directed to take charge of the survey. ...

He ought not to go to the Sunderbunds now; ... my being sick is unfortunate, but it ought not to place him in so responsible a situation. ... Had Captain MacGregor been permitted to join me at the time of his appointment, ... he would have seen enough of the country and the survey...to take charge of the business now, but he did not join, and lost the opportunity.

When I was an assistant myself, and when I had Lieutenant Schalch as my assistant [II, 17 n.2], it was always customary for the surveyor and assistant to be together during the season that the work was at a stand. I should therefore imagine that...Captain MacGregor's proper place would be with me if the boats are discharged[2].

Though Mackenzie had met Hodgson at work in 1814, he knew nothing of Herbert who was taking over the Garhwāl survey [35, 303];

I feel very much at a loss; all this would be removed by...the usual practice...of intimating when a surveyor is removed, relieved, or appointed, and whether the survey is to be continued, and by whom. I do not by any means presume to interfere in their appointments, and only desire to be informed...to enable me to report when called on. ...

Of Mr. Herbert, I am glad to hear your favourable opinion. The Principal, Captain Hodgson, would also have weight with me, ... but I consider the appointments of all surveyors and their assistants the peculiar prerogative of the Governor General [I, 269], and when at any time the opinion of the Surveyor General is asked as to professional matters, it should be framed on his knowledge of proficiency or talents. It is for this reason that I would recommend that specimens should be regularly submitted. Had Mr. Herbert's field books only been sent down as I proposed, I could be prepared to bear testimony to his merits. You see Captain Hodgson declined this, and even quotes the regulations against it [347, 354–5].

[1] DDn. 154 (53), 19–12–18; Engineer cadre, Bengal, 1820, 36 officers only. [2] from Morrieson, 27–4–18, DDn. 147 (137–42).

Captain Hodgson's removal to another duty, and his sickness, interrupts his closing it. Mr. Herbert is a promising young man. Do you think he has experience enough to conduct operations that may come in contact with the most scientific men in Europe? That he possesses ardour and all that theoretical knowledge that would justify his appointment in any common case I can believe. ... Would it not be a good plan to put the whole of that Thibet survey, ... from the Jumna to Almora, under Captain Webb's direction? Both, in fact, tho' separated at first by accident I presume, ought to have formed but one work; Mr. Herbert might then be...advanced in salary and comfort, while he and the public derived confidence from Captain Webb's experience and talents. About the latter there can be no hesitation after the strong testimonial he has produced from the Astronomer Royal [44]. ...

There is another officer in this country who has very strong testimonials from the Astronomer Royal; he belongs to one of H.M.'s Regiments of Dragoons[1]. I know not how he comes not to be employed. I have not the honour of being known to him, but I presume it is owing to a modest diffidence that sometimes keeps back men of merit, and perhaps to a not illaudable spirit that, in time of action, keeps back solicitation. Such men should be sought for, provided the public expenditure permitted, but these economical regulations make us all timid. ...

To return to the Kumaoon...surveys; ... I have lately applied for an assistant draftsman to Captain Webb, a young man who I trust will be useful[2], and if two native assistants could be attached to him, ... we might expect a good account of the whole of that country in a reasonable time. It has been now going on for 4 years, I think, but with a lame establishment, for...that work should never have been committed to two separate officers without aid or assistants. ... In such a situation, in wild tracts, in rugged narrow valleys where the passage from one to another is even a matter of difficulty to men in all the vigor of health, what is to be expected but...vexatious interruption, and, the result of all, ill-health?

You will see, I am an advocate for all these works, but...on a regular system of subordination—work well—and pay well[3] [t-page].

He was most anxious to get Thomas Oliver as assistant to Herbert [38];

When I last took occasion to mention your name...to the Governor General, His Excellency seemed inclined to think the situation rather belonged to the Quarter Master General [334–7]. I almost gave up the pursuit in despair. ... I recommended the proposition again thro' Mr. Metcalfe's medium; ... I believe...it only requires now to be brought before Council. ...

Drawings of plans have at all time been considered an essential qualification for a surveyor. ... Drawings of all kinds, views, etc., have...promoted the advancement of officers, but that of map-drawing, tho' somewhat neglected of late, is...an essential, next to...adequate mathematical...knowledge, ... whose application to the different kinds of surveys can only be acquired by practice[4].

Two surveys, Garo Hills and the Sundarbans, had been closed down because of the surveyors' death or sickness [12, 49], and after Garling's death at Hyderābād [117], Mackenzie urged the Madras Government to make it a regular practice to appoint a second officer to every survey, as had been recommended by every Surveyor General from Rennell onwards [I, 270; II, 311].

From the interruption...and...loss of materials from the death or sickness of single officers employed...in distant and...unwholesome situations, ... I...[suggest] two expedients which... might...accelerate the completion of the provincial surveys, and...prove less expensive...than... appointing only a single officer to survey, sometimes of little practice, ... and not sufficiently ...inured to the climate. ...

1st. That to every surveyor on a provincial survey...an officer as Assistant Surveyor be attached. ... These assistants should afford specimens of their qualifications in geometry, mathematics and drawing, to the satisfaction of the Assistant Surveyor General at Madras. ...

2nd. That in all cases of the death of officers or surveyors employed in the provinces, the next senior seal up the effects, and apply to the nearest competent authority, civil or military, for an inspection of the effects of the deceased, that the official documents may be transferred to the proper channel, and private property secured for the proper claimants. I believe this is already the practice in the military branch of the service[5] [341].

Though the Madras Government accepted these recommendations in principle, no immediate action was taken [341–2], and it was only in the revenue surveys of Bengal that Assistant Surveyors were posted as a matter of course. Hodgson informed Bombay in 1822 that under the Bengal Presidency

[1] not identified. [2] Robert Tate [367–8]. [3] to Sec. Mil. Dept.; DDn. 154 (21), 12–9–18. [4] ib. (90–2), 11–6–19. [5] DDn. 194 (113–5), 13–10–20.

the Surveyors are all commissioned officers of the Hon'ble Company's service, and are usually chosen from their tried abilities, and appointed to conduct operations which have hitherto been of a geographical nature. There is no regular gradation, and the appointment ceases with the work. Occasionally a surveyor has an assistant appointed who is a commissioned officer also, and received a salary of 100 rupees a month[1] [II, 311].

When Blacker took over charge he found himself left with only one surveyor in the Bengal Presidency[2], though there were a number on revenue surveys under the Revenue Surveyor General [333], and others on road surveys under the Quartermaster General [27, 337]. When, therefore, the Directors called for surveys to provide a general map over the whole of India [283], he pointed out that

at present there is not a single individual employed under the orders of the Surveyor General in India in the Bengal Presidency, except Captain Everest and his establishment, recently arrived on the Nerbudda ; nor am I acquainted with the names of any officers who are qualified to be employed on survey that are not already attached to the Revenue Surveyor General, or otherwise provided for. The paucity of Engineer Officers compared with the demands for their services in the field, in garrisons, with the Sappers and Miners, in the civil Building and Barrack Departments, leaves none disposable to exercise the elementary knowledge of surveying they acquired at Addiscombe [II, 308 ; III, 283].

It is otherwise under the Bombay Presidency, where all the surveys are superintended by Engineer Officers[3], some of whom are...found among the Assistants [343–4]. The Madras surveys continue to be performed by some few officers...educated at the Military Institution, assisted by the remains of the Revenue School, for there, as well as under the Bengal Presidency, the junior engineer officers seem to prefer other branches of the service. ...

The pay...on this establishment is not inferior to that on either of the others. Yet, as on the Revenue Survey in the Company's abundant provinces there are fewer privations to be suffered than on general survey, ... whilst the allowances are the same, it is not surprising that individuals who have both lines open to them should have chosen that which presents fewest difficulties. It might be equitable perhaps on this account to propose a higher rate of pay for officers employed on general survey. ...

To have systematic results there must be systematic instruction, and the only part of the Army who enjoy the opportunity of that advantage are the officers who are educated at Addiscombe. They, however, appear...not to covet employment on survey, and geodetic operations are consequently at a stand. In this dilemma, I can suggest no remedy but that of sending out professional surveyors as well as professional astronomers [185–6]. In both cases the individuals would be unacquainted with the language and customs of the natives, and unseasoned to the climate, ... unquestionable evils ; but their skill and knowledge of natural science...much more than what can be expected from the casual self-instruction of military officers who have other pursuits, and no favourable opportunities for learning[4].

Hodgson was glad to find a useful surveyor in Alexander Boileau [24] ;

As the Hon'ble Court is desirous that when...officers of the Corps of Engineers...be available they should be employed as surveyors [283–4][5], I made enquiry...respecting...such of their juniors as, having been a sufficient time in the country to have attained some local knowledge, might be desirous of being employed as geographical surveyors, and I was informed...that Lieut. A. H. E. Boileau, now employed in the district of Allahabad with the Sappers and Miners, was...an officer possessing the necessary qualifications[6].

Before his departure on furlough he pressed the worth of his brother officers in the infantry for any new survey ;

The Bengal Army, which has never shewn itself deficient in talent, will furnish a sufficiency of qualified officers. ... Government is aware that the senior officers of Engineers, who possess sufficient local knowledge to make them useful as surveyors, have more pleasant and profitable duties open to them, and nothing but necessity, or a strong bias towards the science, ever made any man serve in the dangerous and arduous work of surveying ; the younger Engineer officers can be of no use as surveyors till they have a competent knowledge, not only of the language, but of the customs, prejudices, and peculiar feelings of the natives.

These difficult attainments are required in no common degree by an officer who passes his life among them without any European society, and whose business it is, not only to perform the mere professional part of his duty well, but to gather information. ... No small tact and

[1] DDn. 198 (31), 9–3–22. [2] Gerard, in Mālwa up to April 1824 [89]. [3] But neither Sutherland nor Cruikshank were Engineers. [4] DDn. 204 (105–7), 11–8–24. [5] CD to M. 23–3–16 (4) ; CD to B. Mil., 25–5–26 (75) ; 16–4–28 (17) ; 18–6–28 (64–70). [6] DDn. 204 (325) ; 5–7–27.

experience are requisite to know what questions to ask, and how to ask them. So different are idioms and feelings in England and in India, that what is considered complimentary in one is regarded as insult in the other. ... As has often been the case, a matchlock ball from a distance would warn him not to pursue investigations which appeared...laudable and harmless. Surveyors are always regarded with distrust and dislike by the natives, many of whom believe that they are condemned to measure the roads and rivers as a punishment for crimes committed against the State, and...may be insulted with impunity [149, 345].

I mention these things to show how utterly useless, nay prejudicial, any attempt would be to employ what have been termed "professional surveyors" who have not local knowledge; that knowledge which places the Company's civil and military servants so high above all classes of persons in this country, or who could be sent to it. ...

Young Engineers should, as the Court desired, be employed as surveyors when their local knowledge renders their services valuable, but...they...cannot be expected to remain in the most laborious of all duties longer than they can avoid, and we will find, as we always have done, that those who effect the most in the cause of geography...and scientific research are, and will be, the officers of the Native Army, captains and old subalterns, men accustomed to march from one extreme of this vast country...to the other; observers of localities and manners, and learned in the school of necessity and expediency. ... But I need not dilate on the attainments and merits of the Bengal officers; the records of many learned societies here and in England evince them, and will continue to do so if such merits are encouraged. ...

In Hindoostan the lines of research run from the Nerbuddah across the snowy mountains to Tartary, and from the Indus to the borders of China on the east, and of this vast tract... much has been explored and surveyed, ... and a knowledge obtained of regions and rivers, of which a few years ago we hardly knew the names. ... And this has been done at a small expense, and by a few officers, not young Engineers taught to survey after the manner of schools in England, but by intelligent and well-informed officers of the Bengal native army. ...

Compared with the operations of the surveyor-geographers in this extended field, those of the other surveyors are like the work of coasters compared with that of navigators; they are nevertheless sufficient for the purpose in hand, and the Madras and Bombay surveyors work with great neatness; their maps are well drawn, and they have the great advantage of subordinate assistants who excel in the mechanical duty of copying. If such were allowed to the Bengal geographical surveyors, they would be able to do much more, and to save the valuable time they are obliged to throw away on work which can be much better executed by native-born christians and native sub-assistants and draftsmen. By...their aids, the Madras and Bombay surveyors...conduct their operations with great regularity[1] [126, 281].

John Malcolm once gave the following advice to "Cornet M" [Montgomerie ?];

A young man...should never be balancing about climate or expences. If you are wanted to survey—if you get 100 rupees, 50 rupees, or nothing—you should volunteer. Calculation about...expense is stuff and nonsense. It should be your pride to be above these luxuries[2].

We have had occasional references to awkward situations arising from military surveyors not being under the orders of the local military commander [I, 272–3; II, 288]. Mackenzie's advice to Buxton on this subject was eminently practical;

My private sanction would not do. ... You should report your coming away to the Commanding Officer where you are, tho' in fact you have nothing to do with military duties at present; but it is an act of civility due from all officers to superior military commanders[3].

REVENUE SURVEYS

For the start of the revenue surveys of the Upper Provinces of Bengal, Hodgson had to collect a number of surveyors and, though the work was entirely of a civil character, his choice with few exceptions lay with infantry officers;

Though we may avail ourselves of a cheaper agency...in the details, ... the Superintendent of each survey must be a British officer, of experience, ... not only professionally as a Surveyor, but in the language and customs of the high-spirited natives of Hindoostan. To execute a difficult and delicate duty, he must possess firmness and moderation, ... to prevent or modify disputes between the landholders and his own assistants[4]. Though the...revenue

[1] DDn. 231 (236–52), 24–1–29. [2] Kaye, II (386), quoted by Davis (9). [3] DDn. 156 (162), 4–7–19.
[4] from SG., 20–7–21; BTC. 7–9–21 (27); *BRS*.

surveys are instituted for civil purposes, the officers...employed on them...acquire many qualifications highly desirable to military men[1]. ...

It is matter of no small difficulty to me to lay before Government the names of officers possessing all the qualities requisite. ... Captain Oliver, of the 6th Regt., at present employed in the mountains in succession to Lieut. Herbert [38–9], ... will not be available...before the beginning of next cold season. ... He bears a respectable character, is of sufficient standing in the service to have a knowledge of the manners and prejudices of the natives, and has sufficient skill...to conduct a survey. But of his real merits, capacity, and fitness, I shall have better opportunities of judging ere the period of his present duty is expired. ...

Lieutt. Pemberton...I think well qualified to be an assistant. ... The name of this officer is...favourably known...as a distinguished student in the College [II, 308], and an oriental and general scholar of promise. ... His character is highly respectable, and he has a competent knowledge of surveying...for the station of an assistant [65–6].

There are at present at Moradabad two officers of the 24th Regt. N.I., who have lately, at the private request of Mr. Halhed, the Judge and Magistrate [152–4], ... been...making surveys of the civil and military stations of Moradabad. ... The plans are executed with commendable accuracy, and the field books accompanying them are correctly arranged. I do not personally know Lieutts. Bedford and Hadaway, but I think...they may be employed advantageously in the Rohilcund revenue surveys. They are officers of about 13 years standing in the service, and I understand their characters are respectable.

I also...submit...the name of Mr. Horatio Nelson as a person whose services may be found useful. ... This gentleman...has been...in the Navy, and was latterly an officer in one of the Corps of Irregular Cavalry, which was disbanded, and...is consequently out of employment, and is solicitous of being employed in surveying, for which he has some talents that may improve by experience. ... Worthy of trial as an assistant...on a salary of Rs. 250 a month [151, 165].

With a tribute to "the well-known zeal and ability of Mr. Halhed", Hodgson obtained the appointment of Bedford Hadaway and Birnie Browne as assistant revenue surveyors in Morādābād District, with the prospect of early promotion. Pemberton took up three apprentices from Calcutta, and Nelson joined about the same time[2] [154]. Pemberton had to be appointed D.A.Q.M.G., as he had less than three years service [II, 309];

Officers who have actually served one year with their corps shall in future be considered eligible to the situation of aide-de-camp, or to be appointed to the Quarter Master General's Department, and...after three years of regimental duty, they shall be competent to hold any other official situation open to officers of their ranks in the Army[3].

Oliver was posted to charge of the revenue survey of Delhi, and William Brown joined him as assistant after the rains of 1822[4].

Grant who had been working in Gorakhpur District for several years [20–2, 151–2], had to take sick leave to the Cape, the Surveyor General obtaining a ruling for him to draw recess allowance during the whole period of leave; "the amount, however, is not to be drawn until...return. ... Of course also if the survey should be discontinued the allowance will cease"[5]. He was relieved by Wroughton, who was promoted Surveyor from 1st October "when field operations commenced".

Further changes occurred in 1823. Hadaway's health broke down and he died in April. Pemberton and Nelson went sick. Simmonds of the 28th Regt. N.I. was posted to Delhi, and Wilcox of the 30th to Rohilkhand. Both had served with their regiments upwards of three years. Wilcox was a good oriental scholar, and a student of the College [*sup*][6].

In July 1824, owing to the outbreak of the Burmese War, most military officers in civil employ were recalled to military duty [151], and Government ordered that

all public works likely to occasion any considerable disbursement and which are not of indispensible necessity...shall for the present be suspended. ... This Resolution applies to the employment of Military Officers on civil duties. ... The surveys cannot be suspended without serious inconvenience (for the work is a most important one); still, ... the inconvenience likely to result from their discontinuance is much inferior to that which must be the consequence of a paucity of officers with the corps[7].

[1] DDn. 196 (120), 24–10–21. [2] BTC. 27–11–21 (23). [3] GO. to GG in C. 18–3–20, amending that of 20–8–11 [II, 309]. [4] BTC. 1–8–22 (111). [5] ib. 10–7–23 (32), 7–7–23. [6] from RSG. 8–11–23; ib. 5–12–23 (46). [7] BTC. 30–7–24 (38).

Officers on revenue surveys other than Delhi were withdrawn, and those not required with their military units employed on geographical surveys under the orders of Schalch[1] [*inf*]. In July 1825, after his death, they were transferred to the control of the Surveyor General [53, 68]. The following were the officers employed on revenue survey in 1824 ;

			Appointed	District	Burmese War
Revenue Surveyor General					
Capt.	J. A. Hodgson	...	23-10-23	——	——
Surveyors					
Lieut.	P.W. Grant	...	14- 9-21	Gorakhpur	Burma, July 1825 to Dec. 1827.
	Leave to Cape, 10-5-24 to		12- 5-25		
„	R. Wroughton	Asst. Survr.	19-10-21 5-12-23	Gorakhpur	Arakan, Oct. 1824 to Jan. 1826.
„	J. Bedford	Asst. Survr.	27-11-21 19-12-22	Rohilkhand	Assam Valley, Dec. 1824 to Sept. 1826.
„	B. Browne	...	22-11-22	Morādābād (N)	Cāchār, Jan. 1825; Burma, Sept. 1825 to March 1826.
Capt.	T. Oliver	...	1- 8-22	Delhi	——
„	B. Blake	...	8- 2-22	Noākhāli (or Bullooah)	with regiment from Oct. 1824.
Lieut.	T. Fisher	...	1- 8-22	Sylhet	Cāchār, from Jan. 1824.
Ens.	T. Prinsep	...	16- 3-21	Sundarbans	Arakan, from Dec. 1824.
Assistant Surveyors					
Lieut.	R. B. Pemberton	...	1- 2-22	Rohilkhand	Cāchār & Manipur, from Jan. 1825.
„	R. Wilcox	...	5-12-23	„	Assam Valley from Dec. 1824.
„	W. Brown	...	22-11-22	Delhi	——
Capt.	J. H. Simmonds	...	5-12-23	„	——
Dr.	J. Duncan	...	23- 1-23	Sundarbans	——
Mr.	H. Nelson, uncov.	...	27-11-21	Rohilkhand	Arakan, Nov. 1824 to June 1826.
Mr.	J. Blechynden, uncov.		9-10-23	Sylhet & Assam	——
Mr.	R. Macan	...	9- 7-24	Gorakhpur	Arakan, Oct. 1824; Burma, from July 1825 to March 1826.
Capt.	H. Tanner	...	4- 7-22	Bhāgalpur	

The orders posting the surveyors to military duty read as under ;

1st. That three temporary companies of Pioneers...be raised at Chittagong. ...

2nd. That the command and general superintendence...be committed to Captain J. A. Schalch, Superintendent of Canals and Bridges [13], with the local rank of Major, and attached to the head quarters of the Army during the present war.

3rd. That the following officers be placed under the orders of Captain J. A. Schalch with the least practicable delay ;

Capt.	J. Taylor	... 5th B.C. [14].	Lieut.	R. Wilcox	...	59th N.I.
Lieut.	J. Bedford	... 48th N.I.	„	R. B. Pemberton	...	44th N.I.
„	R. Wroughton	... 63rd N.I.	„	G. Thompson	...	Engineers
„	B. Browne	... Artillery.	„	J. A. Crommelin	...	„

4th. That the following uncovenanted surveyors and apprentices be attached [364–5]. ...

R. Macan	W. Polhill	J. H. Schencks
H. Nelson	A. McPherson	J. Dumbleton.

That the Officers and Surveyors above-named be formed into a Department, distinct and separate from that of the Quarter Master General, to continue during the war, and to be employed in the construction of bridges, improving or opening roads, and generally... facilitating the movements of an Army. ... Accurate surveys of the line of march, and of the rivers and streams in it's vicinity will be indispensible. ...

That the officers composing the department, with the exception of the Engineer officers, be transferred from the duties on which they are now employed, and attached to the Army, holding their present situations, to which they will return on the termination of the war. ...

The Head of the Department will furnish the Surveyor General...with copies of all surveys that may be made, ... and...on the termination of the war all records of the department shall be delivered over to the Surveyor General[2].

The party from Morādābād came in to Fatehgarh on 23rd October, and started down the river by boat almost immediately, whilst the party from Gorakhpur started down on 20th. Though Hodgson offered his own services and those of the officers of the Delhi survey, they were not required[3].

[1] BSC. 10-2-24; BTC. 17-9-24 (28). [2] ib. 17-9-24 (28). [3] ib. 3-11-24 (39, 40).

In 1826 Hodgson reported that most of these surveyors had rejoined their surveys. Amongst new assistants now appointed were Alexander Hodges and George Fraser, the latter being brother to William Fraser of the Revenue Board at Delhi [151]. Another was a civilian, Robert Terranneau, descendant of the French artillery officer of Chandernagore fame [I, 221–2, 388], who was recommended by Halhed [332][1].

In January 1827 Government refused to appoint Roderick Macdonald, because there were already five officers of his battalion holding staff appointments, the maximum number of absentees allowed [311, 399]. He was posted to the Meerut Survey a year later on the death of one of these five [158].

Under a rule that officers had to revert to regimental duty on promotion [342], Wroughton's transfer was ordered early in 1830[2]; though Herbert did his best to prevent it, and urged his industry and ability,

> as one of the first, if not the very first, of our surveyors. ... His place will not be easily supplied. If it be the intention of Government to continue and extend the system of Revenue Surveys, ... it would be very desirable and most conducive to the efficiency of the public service to retain Captain Wroughton in the Survey Department, nor do I hesitate to give my strongest...recommendation to that effect[3].

Though Wroughton was allowed to stay on till October to close the maps and papers of the Gorakhpur survey, Government insisted on his rejoining his unit in October 1830 [152]. He was reappointed in May 1832[4].

QUARTERMASTER GENERAL'S OFFICERS

The prolonged absence of Mackenzie at Madras, and Crawford's retirement, left the seat of the Supreme Government at Fort William without a Surveyor General during the critical times of 1816–7, when the Commander-in-Chief and his army had the utmost need for maps and survey advice [300]. In this situation Lord Moira, who combined the office of Commander-in-Chief with that of Governor General [225], conceived the idea of forming a regular cadre within the Quartermaster General's establishment, whose duties should include not only surveying, but also all the various functions of quartermaster [II, 300–1]. Though it was to be somewhat on the lines of the Survey Branch of the Quartermaster General's department in Madras, the latter only dealt with military surveys that could not be undertaken by the Surveyor General's own staff.

In Bengal, surveyors were only appointed under the Surveyor General for the duration of a particular survey, formally sanctioned, and not as members of an authorized establishment. Under the new scheme the Surveyor General was left responsible for the custody and compilation of maps, and for surveys specifically authorized by Government. For these he was invariably to call for officers of the Quartermaster General's staff, unless "war or the preparation for war" rendered them unavailable. This scheme was authorized from January 1817, and filled Mackenzie with alarm and despondency; he very naturally considered it an infringement on his functions, and a potential source of friction [303–5]. The following extracts are taken from the Governor General's minute of 31st May 1816;

> The necessity for such a provision has been recognized with the army of Fort Saint George [II, 321–2]. A Quarter Master General's Department, excellent in its operations, exists there, while the Q.M.G. and Deputy Q.M.G., the whole establishment in this presidency, are nearly useless here for want of...instruments. ... At present we have a number of officers... annually employed in making surveys. The allowance to each is 586 rupees monthly (Rs. 618 for each of nine months, and Rs. 250 for each of 3 wet months, average 586).
>
> Say that ten officers are employed; ... the amount of their allowances would meet the pay of ten or twelve officers...in the Quarter Master General's department. I should propose to take...all those of late engaged in surveys [II, 311–2], except the Engineer Officers, who

[1] BTC. 24–8–26 (44). [2] promoted Captain, 26–8–29. [3] ib. 27–4–30 (16). [4] DDn. 261 (97), 15–5–32.

have ample duties to perform in their own line. ... All future surveys should be executed by the officers of this department. ... The department would stand thus ;

Quarter Master General—Deputy Q.M.G.—now existing.

Six Assistants—of whom the two eldest should have superior allowances...

Six Sub-Assistants—of whom three should have superior allowances.

The names of the officers whom I recommend, with the salaries proposed...are annexed.

It is beyond what has been employed in surveying in any one year ; accidental pauses... having frequently occurred in almost every survey. But...there will be great convenience in having an officer of this department at each of the principal stations, whilst the others are engaged in examination, measurement, and delineation in distant quarters. ...

If the expense of those additional officers in the Q.M.G.'s department shall not exceed Rs. 6,000 a month, it will be considerably short of what is now incurred for temporary surveyors. ... The Intelligence Department...should be a regular part of...the projected system. ...

Taking the average expenditure for...surveyors during the years 1812, 1813, 1814 (the surveys were mostly stopped during the war), the monthly rate...amounted to 4,292 Rupees. The aggregate...salaries proposed by me fall short of that sum by a trifle. ... The allowances, which I think adequate, are much beneath what several of the gentlemen have been receiving. ... On the other hand, ... their employment will now be permanent, whereas before they were liable to be ordered away to their regiments on any preparation for the field[1].

The allowances [348] covered all expenses, except that surveyors were allowed the use of instruments from Government stores [211]. The Surveyor General was still responsible for professional control. A General Order laid down that

Officers of the Quarter Master General's department...are to be employed without any additional pay on geographical or other surveys. ...

The Surveyor General's Office, as heretofore, is to be the depot in which all geographical knowledge, all plans, and field books, are to be finally concentrated. From that officer all the Quarter Master General's staff employed as above will receive their instructions, and to him they will report ; but their services are at all times to be immediately available for the more military line of their profession on the requisition of the Quarter Master General.

Copies of all plans and surveys...shall be ultimately made out in the office of the Quarter-Master General at the Presidency, and sent for deposit to that of the Surveyor General[2].

The following officers were posted to this cadre on 1st January 1817, and nearly all employed on military service [82–6]. The Quartermaster General being Lt.-Colonal John Paton[3] ;

A.Q.M.G. Capt.	F. S. Sackville	... 28th N.I.	at Headquarters.
" "	E. Barton	... 29th N.I.	with Reserve, Grand Army [34].
D.A.Q.M.G.			
1st Class Lieut.	H. Morrieson	... 29th N.I.	Surveying the Sundarbans.
" "	J. Pickersgill	... 24th N.I.	3rd Divn. Grand Army [II, 437].
" "	H. C. Sandys	... 14th N.I.	Nāgpur Subsy. Force.
" "	J. Franklin	... 1st N.C.	1st Divn. Grand Army.
2nd Class Lieut.	J. N. Jackson	... 23rd N.I.	Supernumerary.
"	H. Hall	... 16th N.I.	with Reserve, Grand Army.
" "	E. C. Sneyd	... 3rd N.I.	Nāgpur Subsy. Force.
" "	W. Paterson	... 30th N.I.	2nd Divn. Grand Army.
" " Cornet	F. Palmer	... 8th N.C.	Officiating.
3rd Class Lieut.	E. F. Strettell	... 6th N.I.	3rd Divn. Grand Army.
" "	W. Garden	... 18th N.I.	1st Divn. Grand Army.
" "	R. S. Brownrigg	... 10th N.I.	..

Mackenzie found it impossible to work this arrangement in a friendly way with the Quartermaster General, Franklin's survey of Bundelkhand being one of the first to disturb him [303–4]. Before the Nepāl war Franklin had been under the Surveyor General and the civil Commissioner. During 1817 and 1818 he was on military duty. On his resumption of regular survey, Mackenzie resented the interest shown by the Q.M.G., and wrote privately to the Military Secretary that he had been

ordered by His Excellency the Commander-in-Chief to send the necessary instructions

[1] BMC. 5-7-16 (1). [2] BGO. GG in C., 1-1-17 ; *CG. Sel.* V (12), 23-1-17 ; see also *IO Tract ; IO Lib. Cat.* I (525). [3] (1763–1824) ; Ben. Inf. Ens. 1785 ; QMG. 1808–20 ; Commy Gen. 1820–3 ; d. Calcutta, 15–2–24.

to Captain Franklin to resume the survey of Bundelcund. This was communicated to me by the Quarter Master General, with a very extensive indent for instruments. ...

It has been always usual, and indeed necessary, that the Surveyor General should know what has been done before he can pretend to give instructions. ... On one point I have made up my mind long ago, that the same surveyor should, if possible, close the province, and... should be liberally recompensed for it. As Captain Franklin has been so long employed on Bundelcund, and as he had proposed before my arrival to send down maps of that province, it would certainly be desirable that he should complete its maps and memoir. ...

As to instruments, such as we have got will be sent by dawk bangy, and the rest purchased ; ... but I doubt that the whole can be sent, nor indeed do I think them necessary[1].

Two months later he records an interview with the Quartermaster General[2], who was obviously anxious to be friendly ;

November 5th. Col. Paton called on me, and after some conversation proposed that his son[3] should be attached to my office—Said I would think of it at parting, but gave no encouragement—...He stated to me in the course of conversation that all his assistants under my orders were entirely under my control, and that I was responsible for giving them the necessary orders—he had nothing to say to them—Yet, in conversation he proposed that I should write to him to propose Captain Franklin to survey Saugur—This I declined—and I thought it very odd he should propose it.

He insisted much that I should go over and dine en famille at his house, and see Mrs. Paton—newly arrived—Went accordingly.

N.B.—In this conversation hinted there were other surveys proposed (meaning Lieut. Johnston's of Bilsa)[4], but declined further notice of it, though solicited.

Mackenzie now obtained orders for Franklin to close survey in Bundelkhand, and after the belated submission of his fieldbooks for the first three months of 1817 [81–2] Franklin was moved to Saugor[5].

About this time also, on representation from Franklin, who had previously been drawing full survey allowance at Rs. 618 p.m., Mackenzie obtained authority that officers of the Q.M.G.'s establishment should draw this full allowance when they provided their own instruments[6].

He again complains of interference from the Q.M.G. [304–5] ;

That officer assured me the last time I saw him those officers attached to me were not under his orders—that they were entirely under mine—& if they did not follow them & I did not enforce them, ... it was my business, &c., &c. ... I wish to be relieved from the constant perplexity their situation occasions, as I can never give any instructions or orders to them that is not frustrated from some other quarter.

I was about to point out to Captn. Jackson something I considered necessary, when, behold, I find he is on his return, [27–8]. ... Is not this, then, interference ? ... His return is, I presume, by some order unknown to me[7].

This drew a firm ruling ;

After the clear and precise manner in which the organization of the Quarter Master General's Department has been detailed and explained, ... the most Noble the Governor General in Council is surprized to learn that any misconception should exist...as to the exact bearing and extent of...employment under the orders of the Surveyor General. ...

Officers...were appointed originally...under the Quarter Master General to meet the call for eventual exigencies. While no demand should exist for their services in that line, it was understood that they were to proceed on those measurements of districts, frontiers, etc., which had before occupied them. ... They were to be regarded as lent, ... and they were for... that special duty to be placed exclusively under the direction of the Surveyor General. They were to be exempt from the interference of the Quarter Master General as they had...been from that of the Commanding Officer of their battalion. ... Their sole communication on every matter relative to that employment was to be with the Surveyor General. ...

Captain Franklin has...been betrayed into an irregularity in addressing correspondence to Lieutenant Colonel Paton on topics properly recognizable by you. ... It is indispensable that Captain Franklin should comply with your requisitions. ... He should have addressed his application for leave of absence...to you, for the sanction of Government. ...

[1] DDn. 154 (21), 12–9–18. [2] Nov. 1818 ; DDn. 69 ; M 262. [3] John Forbes Paton, Ben. Engrs. [II, 436]. [4] Bhilsa, 35 m. NE. of Bhopāl ; Johnstone's survey commenced 1819 [87–8]. [5] BGO. 18–12–18. [6] ib. 15–3–20. [7] DDn. 156 (277), 25–1–20.

All misconception...should be removed from the minds of the officers of the Quarter Master General's Department employed under your orders. Their ignorance and misconception of the established regulations leads to an unnecessary multiplication of correspondence[1].

Franklin's employment under the Surveyor General ceased on his arrival in Calcutta on leave about April 1820, after which he was employed as A.Q.M.G. on sorting out stray maps in Government offices [290–1].

A later order provided that before an officer could be appointed to the Q.M.G.'s staff he should "produce a certificate, either from the Surveyor General, the Chief Engineer, ... or the Superintending Engineer of the province", that he possessed "a competent knowledge of the theory and practice of surveying[2]".

The following is a list of the Quartermaster General's officers in 1825; they all did useful survey at one time or another;

Major	E. Barton	[II, 380–1]	...	D.Q.M.G.	Cawnpore
Capt.	H. Morrieson	[II, 432]	...	A.Q.M.G.	..
,,	J. N. Jackson	[II, 409]	...	A.Q.M.G.	with army in Burma
Lieut.	W. Garden	[27]	...	D.A.Q.M.G. 1st Class	Presidency
Capt.	R. Becher	[87]	...	,, ,,	Dacca
Lieut.	J. B. Neufville	[53]	...	,, ,,	Assam
,,	F. C. Robb	[87]	...	,, ,,	Saugor
,,	F. H. Sandys	[87]	...	,, 2nd Class	Nusserabad
,,	Thos. Fisher	[49–52]	...	,, ,,	Sylhet
,,	J. G. Drummond	[27, 68]	...	,, ,,	Chittagong
,,	John Paton[3]	[27]	...	,, 3rd Class	,,

MADRAS; MILITARY INSTITUTION

In a despatch dated 15th May 1815[4] the Directors ordered the immediate closing of the Military Institution at Madras, on the grounds that the education given at the Royal Military College, which moved from Marlow to Sandhurst in 1812 [II, 308] rendered superfluous any further instruction in India [II, 319–20]. Sir Thomas Hislop, Commander-in-Chief Madras, was disgusted at the decision, but the orders were peremptory, and his protest of no avail;

The students of the English college are doubtless well grounded in the...theory of Military Survey and Reconnaisance, but I am not aware that the subsequent labours of any of these young men in this country have added in any material degree to the great mass of geographical and topographical materials, with which the...students of the Madras Institution have enriched the records of the Company, and...of the civilized world. ...

The Madras Army can at present boast of 119 young officers [II, 320–1], whose scientific attainments...have rendered them capable of exercising the subordinate functions of the Quarter Master General's, the Surveyor General's, and the Engineer's departments. ... The annual expenditure amounts to pagodas 7,376–21–28, ... and even this sum cannot be considered as expended without its immediate return, for 1,620 sq. miles are annually, and most minutely, surveyed during the field practice of the students [II, 125–30, 214–5]. ...

When Sir John Malcolm was sent to form an establishment on the Persian Gulph, ... young officers educated at the Military Institution...were attached to the expedition and, although its object was not prosecuted, they succeeded in compiling the best map...of the countries between the Indus and the Nile that has ever yet been given to the world [II, 131, 280].

The service in Travancore was the next occasion on which the utility of this Corps was conspicuous; a certain number of these officers were employed there with the greatest public advantage [II, 130–2]. ...

The military operations in the Deccan and in Malwa succeeded those of Travancore, and 4 Officers of the Institution were attached to the...field army. The country...had never been traversed by British troops except by General Goddard's detachment in 1779 [I, 38–9], and the geographical materials collected (in 1810)...have given an addition of new important matter to the Surveyor General's Office that must be of the greatest consequence to all future plans of military operations in that quarter [II, 134].

Lieutenant Bayley's conduct in the Quarter Master General's department during the expedition to the coast of Borneo received the most flattering...approbation [II, 381]. ...

[1] DDn. 145 (251), 5–5–20. [2] *As J.* XIX, 1824 (166); Wilson, W.J. (387). [3] nephew of QMG.
[4] CD to M. Mil., 15–5–15 (17–8).

From these very striking examples I would infer that the habits acquired at the Military Institution have a lasting effect; ... for the...mental exercise to which the students are there inured...render the young men ultimately available for important duties. ... No instance is on record of any one officer of the Institution having been brought to a court martial, or... bringing another to trial; ... none have been remarkable for extravagance, or concerned in a duel; and...not one quarrel has occurred at the mess of the Institution.

On every field service...since the expedition to Java it has been considered important to attach to it some officers of this description—The operations in the Southern Mahrattah Country under the late Lieutenant Colonel Dowse [II, 166]—The Detachment against Kurnool in 1813—The force destined for Ceylon under Lieutenant Colonel Thomson—The Army of Reserve last year, and the Division in advance under Colonel Doveton [83–4]—have all been supplied with their due proportion of officers from the Institution. ...

A certain number of officers have been permanently appointed to the Survey Branch of the Quarter Master General's Department, after serving respectively the prescribed period with their corps [II, 321–2], and have been employed, when not engaged with troops on field service, in planning...roads, ... and in framing the estimates of their expences, and...of the construction of causeways and small bridges. ...

The officers...have also been em ployed in preparing military plans and memoirs of all the countries adjacent to the Eastern Ghauts, and have nearly completed this reconnaissance... from Paulghautcherry to the Kistnah. ...

To conclude—the maintenance of the Military Institution...appears in my judgement to be intimately connected with the success of our arms in the field, and depends on the continuance of the permanent assistants in the Survey Branch of the Quarter-Master General's Department in time of peace; for, unless Officers foresee the prospect of some possible advantage, ... it is hardly to be expected that they will exchange the comparatively small labour of regimental duty for the unremitting attendance required...at the Institution[1].

Formal orders abolishing the Institution were issued under a General Order dated 17th April 1816, in which

the Governor in Council takes this opportunity of expressing his entire approbation of the mode in which the duties of Mathematical and Drawing Instructor to the Military Institution have been discharged by Captain Troyer of H.M.'s 12th Regiment.

The Governor in Council has also noticed with the highest satisfaction the testimony borne by H.E. the Commander-in-Chief to the merits and acquirements of all the officers who have been attached to the Institution[2].

The great success of the Military Institution was mainly due to the ability and high character of Anthony Troyer, the Austrian officer brought out by Bentinck in 1803 [II, 130, 315]. After the abolition of the Institution and a short stay in Pondicherry, Troyer settled in Paris until 1828, when he once again accompanied Bentinck on his return to India as Governor General [195 n.4].

QUARTERMASTER GENERAL'S OFFICERS, MADRAS

"The Survey Branch of the Quarter Master General's Department" at Madras was formed in October 1810, on General Hewett's recommendation, to provide a body of officers capable of carrying out surveys and reconnaissances of a military nature, independently of the Surveyor General [II, 301, 321]. The branch comprised 20 officers, all of whom had passed through the Military Institution [II, 320–2]; appreciations by Sir Thomas Hislop have already been quoted [II, 319–20; III, 337–8]. Though this branch was abolished in 1816, these officers turned out much valuable work in the Deccan during the *pindāri* and Marātha wars of 1816 to 1818, under the able direction of Valentine Blacker, Quartermaster General.

It was not the practice in Madras that the Surveyor General should draw all his surveyors from the Q.M.G.'s establishment though this was definitely provided for in the similar establishment in Bengal [334].

[1] C-in-C.'s minute, 15-1-16; MMC. 29-3-16. [2] MGO. 17-4-16; Wilson, W. J., III.

When Mackenzie resumed duty at Madras in 1815 he found only three officers at his disposal—Garling, who completed the survey of Sonda, or North Kanara, by September 1815 [II, 158–9]—with Conner his assistant—Ward, in charge of the Surveyor General's office at Madras.

His first intention was to form four parties—Northern Circārs—Nizām's Territories—Coorg—Travancore. Allotting Garling to Hyderābād, Conner to Coorg, and Ward to Travancore, he obtained the promise of an engineer officer, Duncan Sim, whom he had known in Java, for the survey of Ellore and Masulipatam.

From my knowledge of Lieutenant Sim, ... his capacity and knowledge of the different branches requisite in the Surveying Department evinced while employed by me in the Trigonometrical operations...in Java, ... ascertaining the distances at the attacks on Cornelis in August 1811, where he was wounded in surveying...the new fort...on the east of Java [II, 135], I consider him a proper person to be employed on the survey in the Northern Circars[1].

Sim was, however, called off for the survey of Pondicherry and Kārikāl [98], and in spite of Mackenzie's protests was not released till 1819, when he was wanted for similar surveys of the Dutch territories at Pulicat[2].

The closing of the Military Institution left the survey of Guntūr Circār uncompleted, but at the same time released Mountford, who had been in charge. After completing the fair-mapping of the Institution surveys, and putting their records in order, Mountford was sent back to Guntūr with two of Mackenzie's sub-assistants to complete the survey [95–6].

Before leaving for Bengal, Mackenzie secured the services of John Riddell, who had been one of Lambton's most able assistants [II, 242–3, 245–6, 322], for charge of the office at Madras, an appointment which Garling resented as ignoring his seniority though, as a matter of common policy, seniority was not considered in selecting an officer for a staff appointment of this nature [318]. On Riddell's death in 1818 Mountford was brought down from Guntūr, and ran the office with great success till his own death in 1824.

Mackenzie was now exercised to find a really capable officer for charge of the Northern Circārs survey, which was of particular importance because it would not have the support of Lambton's triangles [99–101]. Though starting from a side near the Kistna [II, pl. 16], the new survey would have to be carried forward to Ganjam on its own triangulation and base-lines, with astronomical observations. Though the assistant surveyors Dunigan and Scott held charge of the Guntūr and Ellore Surveys for two or three seasons, they were not able for independent charge of an important survey of so great an extent.

Most of the officers reared in the Military Institution & with the Trigonometrical Survey have viewed the establishment of the Surveyor General's office since 1810 with distrust, & as hostile to their interests. So many were thrown out of employment, & it was impossible to employ them all. Thus situated, I could not run about to enquire into the comparative merits of Surveyors, or to engage gentlemen whom I would otherwise be glad to employ. While I was away, two were brought in that I am little acqainted with[3], & 2 others are recommended. I cannot tell you the various solicitations I have had, whilst I had it not in my power to bring in but one, and that is an officer of my own Corps.

Meantime the solicitations for employment increase—bishops—judges—fair ladies—& grave magistrates—besides military friends in abundance[4].

He asked Mountford for a list of past students of the Military Institution and was particularly anxious to obtain the services of Montgomerie [II, 320, 430];

You may imagine my surprise at...being called upon to select two officers of the Madras Establishment to be employed on a survey of the Poonah Territory [124–5], ... after the intimation...officially communicated to me at Madras of the entire abolition of any department of survey under the Quarter Master General [II, 322 ; III, 338], and especially when you yourself was on the spot, who, next to Captain Troyer, was competent most properly to appreciate the qualification of such surveyors as had been reared in the Military Institution.

[1] from SG. 14-12-15; MPC. 12-1-16. [2] Pulicat tr. to British, 1825. [3] Garling & Conner. [4] DDn. 156 (67), June 1816 Mackenzie to Josiah Marshall [396 n.2].

I consider it, however, but just...to call your attention to the claims of Mr. Montgomery and Captain O'Donnoghue, both whose works are mentioned in the records of your office, and whose conduct since...gives them an undoubted claim to be employed[1].

As to Engineers ; ... their present system of education at home eminently qualifies them to be employed as surveyors, or in the office of the Surveyor General, which ought to be open to all corps that are qualified, but until I find that Engineers can be retained on these duties, ... I must always decline proposing them, however willing I should be to avail myself of their qualifications, and desirous even to oblige individuals among them [330].

Mr. Sim's case is in point, whom I proposed for a survey in 1816, which was approved of by Government, and yet till this moment is retained on a duty entirely out of our view [339]. This is my creed as to the Surveying Department, ... and I have found nothing here [Bengal] to convince me to the contrary. In fact the Corps of Engineers in both the Presidencies is not strong enough to supply for professional duties and for surveys at the same time [328][2].

I will beg to be relieved from all responsibility for surveyors. I did propose Mr. Sim in 1816, ... and you see I have been thwarted, ... and this new system of ordering the Quarter-Master General to nominate surveyors while I was forbid to recommend an assistant for my own office (as in Mr. Riddell's case) is so completely at variance with the orders of the Court of Directors...that I wish to be clear of all responsibility[3]. ...

For me to propose any officer by name would not be well received. ... Mr. Montgomery has the best claim immediately after yourself. ... If you represent to Government...that an officer should be appointed to take charge of the survey for which Lieut. Sim was originally intended in 1816, and that from which you were called, and...whether the Surveyor General should not be called on for the nomination of an officer, ... I should be prepared to state my opinion. ... Mr. Montgomery is the first that stands in my list. Messrs. Ward and Conner will be disposable bye and bye, but they are inclined for the Deckan. ... You will keep me informed of such officers as you think best qualified[4].

He was anxious that Ward should finish off Travancore himself [109–10, 341], but if either he or Mr. Conner wishes rather to come North, I wish they would intimate so much, as I think the field in the Deccan or the Circars might be open bye and bye. ... Their report of progress is to me more satisfactory than any other survey, because I have less trouble while their work is gradually going on to its conclusion. I think, however, that Ward particularly, if not both, would like to have the merit of closing their work in their own names[5].

Poor Riddell committed one or two errors that have entailed on me some difficulty, but I did not like to contradict what he had done from the best intentions. ... One of these was his ordering the two surveyors in Travancore to act jointly, while I meant it for a temporary arrangement, to begin at each extremity [109]. ... This has occasioned an embarrassment, ...and Mr. Ward might have...complained. ... Mr. Conner was only sent to assist in case of Mr. Ward's being taken off to the Tinnevelly side[6].

Mackenzie's embarrassment was due to Conner being senior in military rank to Ward, whom he wished to be responsible for the survey, though in fact they worked together in the friendliest co-operation.

When asked to make official recommendation of an officer for Masulipatam, Mackenzie left the choice to Mountford, advising him to

point out to the best of your judgement without partiality ; only, for God's sake keep clear of conceited persons. ... I always prefer steady men who will observe the line laid down for them, and conform as far as possible, candidly submitting their observations, but not resisting[7].

With regard to the survey of Rajamundry, ... an officer ought to be sent without loss of time, as it may bring discredit if these assistants are left without a check [339]. ... I leave... you to point out the officer, ... and anyone you propose will be agreeable to me. Avoid litigious characters, who will battle with yourself, and perhaps attempt to undermine you. Chuse sensible discrete men...who will attend to instructions and understand their duty. ...

I could wish that Lieut. McPherson was employed, as Mr. Montgomerie is otherwise provided for [111–2, 125 n.6]. ... The objection to McPherson as to drawing I do not consider...very material, provided he is correct and able to control the labour of others. ... I had a great regard for some friends of his, ... but that would not influence me if he were not competent to the undertaking. ... When you fix on your man you should pave the way by conciliating the Commander-in-Chief. In short, I leave it to your judgement but do not allow yourself to be crossed by the influence of any other[8].

[1] DDn. 149 (39–40), 22–2–19. [2] ib. (27), 2–1–19. [3] ib. (65), 22–4–19. [4] ib. (71), 10–8–19. [5] to Mountford, 23–3–19, DDn. 149 (52). [6] ib. (111), 19–2–20. [7] ib. 149 (82), 27–8–19. [8] ib. (97), 26–11–19.

It was not until February 1820 that a suitable officer was found in Richard Hodges, but he died at Masulipatam in July. Another Institution officer, Charles Snell, was posted in November, and held charge for the next fifteen years, without, however, proving quite the first rate officer that Mackenzie had hoped for.

Mackenzie was greatly shocked by the death of Garling at Hyderābād in June 1820, for though he had not found Garling easy to deal with he had known him for many years, and greatly appreciated his ability. He writes to Mountford ;

Your letter of 15th ultimo notifying the unpleasant account of poor Captain Garling's death reached me several days ago. It was soon followed by a private letter of Mr. Russell's of 8th ultimo, enclosing Hill's report [117]. ... After your own instructions to Hill, it only seemed necessary for me to add what seemed to have escaped your notice, and what more forcibly struck me from the several surveys on this side where papers have been lost by the death of surveyors. The best remedy is what indeed the practice of the service points out, viz., that a court of officers be applied for at the earliest opportunity [329][1].

Two months later he was much distressed by the death of Hodges;

this coming so soon after Captain Garling's is a shock to the survey ; but I trust there are many whose talents and disposition incline them to a pursuit which is certainly not unpleasant, and I have ever found very interesting[2].

As the survey of Rajamundry is at present vacant, ... I really do not know where a champagne, healthy, district can be selected in India for Mr. Conner, and I look upon low swampy plains to be just as unhealthy as hills. ... It is high time now to send an officer to relieve Mr. Dunigan. If a clever officer was sent there, that survey may be considered a good seminary where-from assistants may be occasionally detached to the Deckan when required. ...

I think officer assistants on these surveys would be useful, ... because they acquire experience, and are ready to fill up vacancies. Poor Mr. Hodges suffered from this ; he had been too late from convalescence, and from England, to go at once into those hills. The next should be directed to the country near the sea, the delta of the Godavery, for the first year at least.

I hope you have taken care that Mr. Hodges' surveying materials be secured. I have pointed out...the method to be followed on all occasions [329]. ... Mr. Hodges' papers should be opened under the civil or military customary authority, and not left to Mr. Dunigan's, Mr. Burr's, or Mr. Russell's discretion[3].

After a long debate he decided to send Conner up to Hyderābād ;

Captain Walpole has been recommended to me for another survey some time ago, and I will not forget him ; it will be necessary, however, that he signify his own wishes, and whether he prefers to be employed in the Deckan—in Nagpore—etc. ...

Mr. Poole also, and some others have been mentioned. I conceive Messrs. Ward and Conner should have a preference, otherways they may be thrown out, ... I could wish to know Mr. Ward's own wishes, as he is first on the list I have got. What was Captain Walpole's situation in the Military Institution [II, 320] ? Was he senior to you[4] ?

With regard to the survey in the Nizam's country, I am as friendly to it as ever, that is to say under due restriction ; but I can on no account submit to be made a fool of, to propose surveys and surveyors on my responsibility, who are to be under the sole direction of any Resident or other functionary [117, 304]. ... I think it likely that Mr. Conner will have the choice if Mr. Ward declines it. ... Many officers will be glad to be employed. ... I will send you soon a list of some who have applied, but I think Ward and Conner have a preferable claim[5].

Conner moved up to Hyderābād in February 1821. He got ill on the march and died shortly after his arrival. Mackenzie was not to learn of this further tragedy, for he himself passed to rest only a few days later. Conner was succeeded by Robert Young, of whom Mackenzie had written some time before ;

Colonel Hazlewood,[6] an old acquaintance of mine, has wrote me about Lieut. Young, who is desirous of being employed on the survey, and he considers well qualified from his knowledge of mathematics and drawing. As Colonel Hazlewood shewed his judgement in first bringing Captain Kater to notice, who now makes such a figure in the department of science in England [II, 232, 313 ; III, 238, 254], I am disposed to give credit to his recommendation[7].

Though the Madras Government had accepted in principle the need of an assistant officer in every party [329], repeated representations had to be made to

[1] DDn. 149 (129), 22-7-20. [2] ib. (141) 1, 23-9-20. [3] ib. (152-3), 12-10-20. [4] ib. (129), 22-7-20. [5] ib. (141), 23-9-20. [6] Joseph Haselwood, Mad. Inf. 1791 ; d. 1844 [II, 466]. [7] DDn. 149 (152-3), 12-10-20.

them on the subject[1]. On obtaining Noble's appointment [114], Montgomerie advised Ward that

the object of appointing an Assistant Officer...is that he may have an opportunity of acquiring a practical knowledge of the whole of the duties, ... and thereby rendered qualified to take charge...in the event of your temporary absence or removal. ... You will...communicate to him such instructions as his inexperience may require, and...keep him fully acquainted with the state of the work, so as to ensure its uninterrupted progress.

I anticipate, however, that this will not be the only benefit resulting from your having an assistant officer, but that in due time the survey will thereby be much accelerated[2].

Without this wise precaution it would have been almost impossible to preserve the continuity of the Madras surveys, more especially that of the Nizām's Territories, where casualties followed at an appalling rate. Robert Young, who did not take over charge until December 1821, died in July 1823, before George Arthur, who had been nominated assistant, had joined the party. Crisp, another Institution man, followed Young and had Arthur as assistant until he was moved in the same capacity to Malabar. On Crisp's resignation in April 1827, he was succeeded by James Webb, who had been at the Institution from 1810 to 1812. Morland joined as assistant a year later, and took over when Webb went sick in 1829. He held charge, with occasional breaks, for the next twenty years [119].

Both Ward and Snell had a number of assistants one after another, but the only two who achieved distinction were Du Vernet, who joined Ward in 1828, and Charles Hill, who joined Snell the following year. Both did excellent service for more than twenty years. We have already mentioned Duncan Montgomerie who succeeded as Deputy Surveyor General on Mountford's death in 1824, and in every way justified the high opinion Mackenzie held of him [320-1].

In 1829 Walpole, who had been Garling's contemporary in the first class of the Military Institution, was nominated Surveyor General by Lord William Bentinck, founder of the Institution, on the advice of Troyer, who had been its wise and able Instructor from start to finish [II, 447–8].

Under the Bengal regulations Wroughton had to revert to regimental employ on promotion to Captain [152, 334]. Madras restrictions raised similar difficulties. Whilst officers could not be posted to survey till they had completed two years regimental employ [II, 314], General Order of 23rd December 1827 ruled that,

It being desirable to fix by one general rule the limits under which officers holding staff employments under this Presidency may retain them, or otherwise, on promotion to superior ranks, and to provide generally for all doubts or contingencies, so far as they can be foreseen, ... the following limitations have prospective effect from this date; ...

Surveyor General—Deputy Surveyor General—	no limitation
Surveyors	to the rank of Major, regimentally.

The effect of this rule was that when an officer who had spent something like twenty years on survey was promoted to the rank of major, he either reverted to regimental duty, with which he was entirely out of touch, or else retired. In either case the survey lost an experienced and probably valuable officer.

TRIGONOMETRICAL SURVEY

The happy choice of George Everest to be Lambton's first Chief Assistant is stated by Everest himself to have been personally made by the Governor General, who had been assured of his "eminent degree of science as a mathematician" [225]. Reports had been made of his surveys in Java [II, 137–8], and Lord Moira had taken special interest in "his successful exertions as an engineer in recently clearing the navigation of the Matabhanga and other rivers" [15]. He had been selected to survey the line of telegraph stations to Chunār [270–1].

Neither Lambton nor Mackenzie had any say in the selection, and, indeed, Lambton's own wish had been for Garling, who was working near him in the Nizām's

[1] DDn. 202 (102–4), 5–4–25. [2] DDn. 218 (37), 24–1–26.

Dominions. Riddell writes in November 1817 that he had not

the slightest idea to whom Lambton can be under promises. In 1812, before I left him [II, 246], he frequently talked to me of his intention to go home for a year or two, & of my taking charge of the survey during his absence. He even went so far as to enter on the subject of allowances. Latterly...he had cut me completely. ... Garling, I think, must be the man[1].

Mackenzie wrote at the same time, their letters crossing, telling that Lambton's survey was to be transferred to the Supreme Government, Public Department,

and...a young officer of the Artillery, Captn. Everest, to be Head Assistant on a salary of 600 rupees. Captn. Everest told me some time he had applied to Lambton, who had wrote him he had already engaged to a certain officer.

I really think Lambton ought to have reserved the claims of yourself and of Mr. Hodges[2], and the latter ought without loss of time to apply officially to be employed on the survey. His friends at Madras wrote me about him[3].

And again, when writing of Lambton's proposals for his country-born assistants ;

Coll. Lambton has proposed to add to his number also, and it is under reference to this office. As Lambton will be going home, and he is a stranger to Everest, I conjecture it is referable to someone else ; you may guess who. He also proposes an increase of pay to his people, but whatever is allowed for them, I shall contend for with us [228, 379].

Everest himself writes many years later that "When in 1817, I was originally nominated as first assistant to Lieut.-Col. Lambton, ... Captn. Garling, of the Madras Infantry, was my only rival"[4].

No record is found of any assistant being offered to Everest during the two years after Lambton's death, and he notes later that "demand for officers in the Burmese war prevented any assistant being appointed, ... even could any...have been found who was both able and willing to engage in a work of the kind[5]".

Neither Garling, Riddell, nor Hodge, all three of whom were dead by 1820, had shown themselves more than efficient surveyors and triangulators, or in any way possessed of the genius and force of character later displayed by Everest, to the glorious achievement of the Great Trigonometrical Survey.

BOMBAY

Dickinson held charge of the revenue survey of Bombay and Salsette Islands until 1821, when he handed over to his senior assistant, Tate, who brought the survey to a close in 1827. Both belonged to the Engineers, but their few engineer assistants were mostly removed from the survey during the Marātha war [122–3].

Williams held charge of the revenue surveys of Broach and the more northerly districts of Gujarāt until his retirement, when he handed over to Cruikshank who finally closed all work by 1829 [170–1]. Their assistants, all infantry officers, were at one time as many as seven. Cruikshank was considerably disturbed by the order that officers should not remain after promotion to Major [342] ;

This department having been formed from the original Surveyor General's, and...being the oldest established in the Survey Branch under this Presidency, I myself served as an Assistant in it nearly fourteen years on very moderate allowances, and the two Senior Assistants, at present Captains Ovans and Newport, have acted in that capacity upwards of twelve years. ...

Neither myself nor these officers can hope to retain for any period the situation of the head of the department, which is attained only after long and arduous service, and under considerable sacrifice, ... being so entirely excluded by the nature of our employment from the general field open for military preferment.

Considering the magnitude of the department, together with the great responsibility of the charge, and that the situation of the Head assimilates so much with that of a Principal in civil employment, I hope...to retain my appointment to the same rank as other military men holding Principal civil employment, and that the...two Senior Assistants, ... should be admitted to a higher class than that specified for Surveyors[6].

This application came to nothing, and the survey was closed down. Cruikshank was promoted Major, took furlough at once, and retired two years later.

[1] DDn. 151 (77), 26–11–17. [2] obviously J. T. Hodge [II, 407]. [3] DDn. 156 (309), 5–12–17. [4] Everest (116). [5] DDn. 265 (147–53), 4–2–31. [6] Broach, 7–8–24 ; Bo MC. (camp).

For Sutherland's survey of the Deccan which started in 1817 before the close of the Marātha war, all the Bombay surveyors with any experience of topographical work were soon drawn in, besides officers borrowed from Madras [125]. The Madras officers faded out by about 1822, and when Sutherland became Assistant Surveyor General he handed over to Jopp about nine officers, all of the Bombay establishment. There were frequent changes, and on succeeding as Deputy Surveyor General Jopp handed over to Grafton. The number of surveyors was then reduced, until the survey was closed down in 1830, leaving the trigonometrical survey under Robert Shortrede, who became well-known later for his Logarithm Tables.

Other surveyors to be noted are Thomas Jervis, of the Engineers, whose survey of the Southern Konkan gave rise later to lengthy controversy with Everest [127]; Adams and Challen who surveyed Sātāra [171–2]; and Stephen Slight who made a valuable survey of Kāthiāwār between 1822 and 1825. In 1827 Jopp was informed that no more officers were available, being "so much required with their corps".

UNIFORM

So far as we know, military officers wore the undress uniform of their corps the whole time that they were employed on surveys. Most certainly the students at the Military Institution were expected to wear uniform on all occasions. It is most unlikely, however, that the uniform worn by surveyors at work in the field was always punctiliously correct. In his account of an encounter with a tiger, Thomas Arthur attributes his escape from the fury of the tiger's first rush to the presence of mind with which he threw his hat, "*surmounted with a black feather*", straight in the beast's face [II, 378]. When his camp was raided by *pindāris* [409–10] Grimshaw of the Military Institution lost—regimental jackets—belt with breast-plate—sword—sash—regimental cap complete—regimental greatcoat; but, if he only saved just what he was wearing at work, this came to shirt and trousers, straw hat, and a handkerchief; uniform pattern no doubt ! !

It is almost certain that the surveyors of the Quartermaster General's Department wore correct uniform when on their "military surveys", and that surveyors working on the frontiers, or in contact with troops, would also do so, but we may wonder what kit Morrieson wore in the Sundarbans, or whether Lambton and Everest were correctly dressed in "regimentals" when taking observations with the great theodolite or zenith sector. Certainly Mackenzie is most correctly dressed in Hickey's handsome portrait [II, pl. 22], but was not that a special occasion ? Of all surveyors he might be expected to be the most punctilious in correct appearance on all occasions. On his way back to Madras in 1815, Crawford tells him that "the uniform for the Surveyor General is resembling nearly your own"[1], that is probably to say, resembling that of the Corps of Engineers prior to 1806.

In authorizing the formation of the Survey Branch of the Quartermaster General's Department at Madras in 1810 [II, 321–2], it was definitely laid down that

> His Excellency the Commander-in-Chief is pleased to make the following alterations in the dress of the Army of this establishment. ... The officers attached to the Survey Branch of the Q.M.G.'s Department, as well as the assistants of that Department, are to wear the plain uniform of an A.Q.M.G., with plain buttons, and one epaulette on the left shoulder[2].

It would entail long research to determine the uniform worn in those days by officers of the staff and of the various corps and regiments in the three presidencies, and a comparison between the various portraits reproduced in these *Records* seems to indicate that considerable liberty was allowed[3]. Officers of Bengal Infantry battalions wore scarlet, with facings of buff, white, or yellow. Artillery wore blue with red facings, whilst Engineers wore scarlet with black velvet facings till 1806 when the coat was changed to blue[4]. Staff Officers, probably including the Surveyor

[1] letter of 6–1–15; MPC. 12–1–16. [2] Seton Kerr, IV (97), 12–10–10. [3] MGO. 14–5–1785 discouraged the wearing of "fancy uniforms". [4] BGO. 30–12–06.

General, his assistants and deputies, wore scarlet coat with blue collar and cuffs, but an officer might well, wear his regimentals whilst holding a staff appointment[1].

Blacker was too much of a soldier to overlook the importance of uniform, and obtained authority for a pattern, not only for the Surveyor General, but also for his Deputies. He informs Sutherland that

the Governor General has determined on a uniform for the Surveyor General of India ; and that, in consequence of a reference from the Deputy Surveyor General at Madras, the same has been assigned to him with the usual distinctions for a Deputy.

You may possibly think a point of dress of not much importance, and I have accordingly adopted a private form of address, in case you were averse from changing whatever uniform you may wear at present. But if you prefer the established dress of this department, and will send round a coat which fits you, ... the proper uniform shall be made up here according to it, and transmitted to you with the official authority for wearing the same[2].

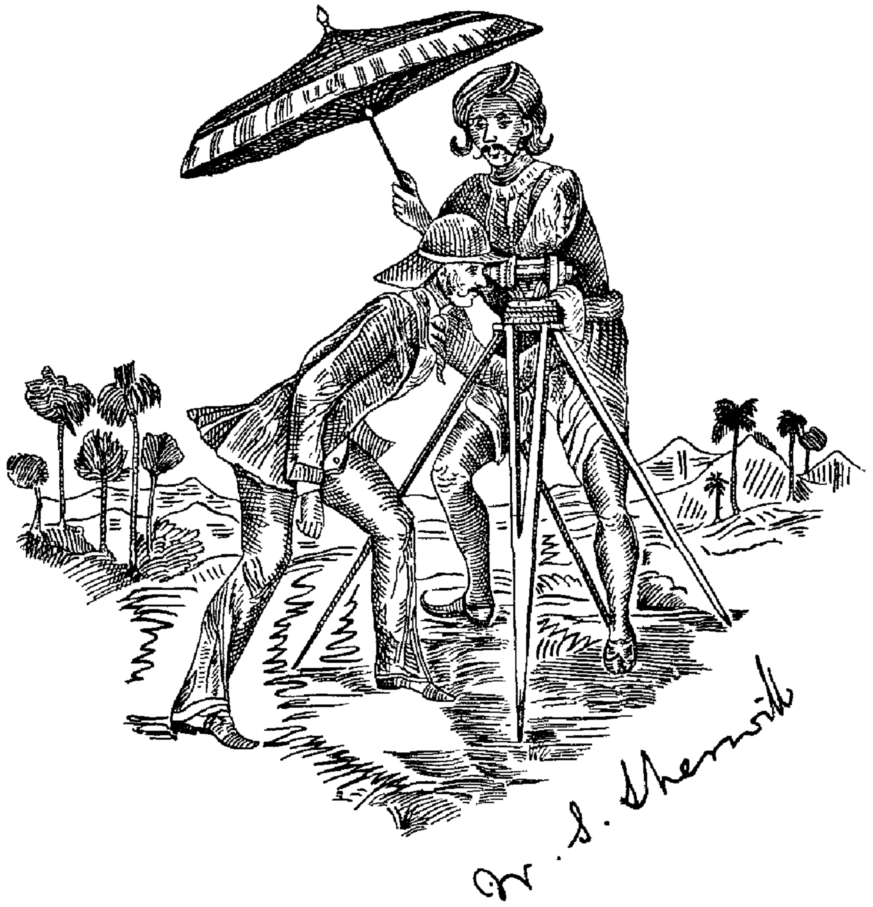
Hodgson was less interested, and writes to Montgomerie ;

I do not know what you can do about the blue coats ; certainly they are very ugly. It is bad policy making any class of officers wear that, or any other colour but red, which the people respect, and we should shew as much as possible. Here no uniform has ever been ordered for the surveyors, and I believe they wear their regimental coats.

I remember that Colonel Blacker, who was curious in matters regarding his own dress, invented a coat different from what Colonel Mackenzie used, and got it approved by the Governor General in Council, not the Commander-in-Chief. Colonel Blacker...sent to Mountford the pattern of this embroidery, and as the Deputies wear it...your Adjutant General might...give the surveyors back their red coats, and you could trim them as you please.

It is not, however, an affair in which I can interfere, but certainly the red coat commands far more respect than blue or green ; at least such is the case in Hindostan, and it is not well to add to the prejudices entertained by the more ignorant natives against surveyors, whom many of them think are condemned to measure roads as a punishment for misdeeds [149, 331][3].

This certainly implies that surveyors usually wore their scarlet whilst out on field work ! See also the front cover of *Manual of Surveying for India*, 2nd edition, reproduced below.



[1] BGO. 11-7-1787 & *Ben. Dress Regs.* 6-3-1823 confirm this. [2] DDn. 223 (6), 24-1-24 ; *Ben. Dress Regs.* contain nothing about uniform for Survey Dept. [3] DDn. 229 (58-9), 12-10-27.

CHAPTER XXIV

PAY & ALLOWANCES

Bengal — Madras — Bombay — Great Trigonometrical Survey — Fieldbooks & Journals.

THE allowances fixed for Bengal surveyors in 1785 were Rs. 618 p.m. for nine months of the year and Rs. 250 p.m. for three months during the rains [II, 326]. River Surveyors were allowed an extra 240 for the hire of boats. Assistants drew Rs. 100 p.m., with Rs. 195 extra if employed on rivers [I, 277]. These allowances covered all expenses for instruments, stationery, transport and followers, but were over and above regimental pay, *batta*, gratuity, and tent allowance of military rank. With special sanction officers were allowed to draw instruments or stationery from Government stores, or to charge contingent expenses.

The following table shows the basic rates of regimental pay and allowances for Bengal officers in the field[1]. In cantonments half-*batta* only was drawn, and allowances for Engineers were halved. House-rent and horse-allowance were extra, when applicable.

	Pay	Allowances	*Batta*	Gratuity	Total
Lt. Colonel ..	Rupees 240	150	600	..	990
Major ..	180	120	450	..	750
Captain ..	120	75	180	36	411
Lieutenant ..	60	50	120	24	254
Ensign ..	48	50	90	12	200

The Surveyor General of India drew an allowance of *sonaut* Rs. 1,500 p.m., and full *batta* wherever he might be [II, 325][2].

The regulation survey allowance did not provide for the heavy expense of travelling in the Himālaya districts, and Hodgson was quick to ask for relief;

> The survey I am about to undertake will differ widely from those...carried on in level countries, and...much time and labour will be required in erecting signals...to be visible at great distances. ... Many people must be employed...to fell the trees, and...to erect them; also cordage to stay them, and large flags. ... To defray the expences of the above, as well as the carriage of the ponderous surveying instruments...in the mountains, where every article must be carried by men, as well as the...charges for measuring the base, and other expences to which a Surveyor in the plains is not liable, I respectfully entreat...that I may...charge such extra expences to the public account; ... also...to indent on the nearest magazine for such cordage, bunting, tools, and other articles...as can be had[3].

Sanction was granted provided the contingent bills were countersigned in the Surveyor General's office. To meet a similar petition from Webb, Government authorized a special allowance of Rs. 200 p.m. from 1st November 1815, that was later extended to Hodgson and Herbert. Webb estimated his transport expenses at Rs. 300 a month, with coolies @ Rs. 4 each, as against Rs. 84 in the plains[4],

Tents	.. 20 Coolies	Instruments	.. 12 Coolies
Bed & Bedding	.. 3 „	Books & Maps	.. 4 „
Table & Chair	.. 2 „	Clothes, &c.	.. 8 „
Wines & Necessaries	.. 12 „	for Servants	.. 4 „
Letters	.. 8 „ @ Rs. 5 each.		

Hodgson's assistants, Edward Garstin and Paton, expected a staff allowance of Rs. 350 a month, but the Auditor General reduced it to the normal Rs. 100. On appeal they were allowed to draw the higher rate up to the date on which they received the auditor's ruling. As they found it utterly impossible to work in the

[1] *EIR.* 1821. [2] CD to B., 10-3-15 (1). [3] BMC. 9-2-16 (35). [4] DDn. 191 (243), 13-7-21; 141 (317), 19-8-17; BMC. 16-12-16 (35).

hills on subalterns' pay and this reduced allowance, they both resigned. Herbert, who followed, was able to manage as he drew the extra hill allowance of Rs. 200.

Gerard, when working for the Board of Commissioners in Sahāranpur and the Dūn [22–3], drew salary of Rs. 350 p.m. with special addition of Rs. 150. His assistant, Blandford, was allowed Rs. 200 p.m., as also was Webb's assistant, Tate. The geologist Laidlaw was allowed Rs. 600, as drawn by Everest and Voysey [266], and permitted to "draw from the Hon'ble Company's Apothecary...such medicines, instruments, tests, and other materials...as the Medical Board may consider necessary" [267][1].

Both Hodgson and Herbert had the greatest difficulty in getting their allowances and contingent expenses passed by the Auditor General, the most frequent objections being the lack of fieldbooks countersigned by the Surveyor General, and their claim to draw full rates during months that were officially too wet for outdoor work [217–9]. Hodgson was particularly hurt that for the period November 1817 to January 1818, when he took leave and surveyed the route from Delhi to Jaipur with the Army of Reserve [34], it was ruled that he was entitled to nothing more than the Rs. 100 p.m. allowed to a regimental officer for keeping a route.

My bills for survey allowances for...November, December, January, and February also, have been returned unaudited. I imagine the reason for refusing payment of the three first months is that I was with the Reserve, but I...beg to be informed...why the bill for February is not passed, as I was actually engaged in operations...belonging to the mountain survey.

The sum of 2,472 rupees has been now deducted from my allowances, and the Auditor General has retrenched the allowances of Lieut. Herbert in such a manner that the Paymaster only allows him 150 rupees a month. Besides the ordinary expences of an officer, his actual disbursement on account of extra carriage amount to 200 rupees monthly for hill coolies alone. ... Thus there is nothing left but my regimental pay of 400 rupees, and the 150 rupees left to Lieut. Herbert, to pay...the public account and to support ourselves.

I have been obliged to borrow cash that the survey may not stop, but I fear cannot do so much longer, as money is not procurable in these mountains. For want of means, I fear my researches will be greatly crippled...and that a foreigner may be able to penetrate where the officers of Government cannot, as without money I cannot bear the expences, both public and private, of both myself and my assistant. The Auditor General's reason for retrenching Lieut. Herbert's allowances is new, ... that his bills were not signed by me. ... I never heard...that the bill of an assistant...should be signed by the Surveyor[2].

As the allowances of a surveyor are not certain, nor his situation permanent, and...several embarrassing circumstances arise, causing great delay ere he can receive his salary, which he forfeits if sick [349], or is unable to make a certain daily progress which is ordered by the regulations to be 5 cosses per day [II, 201 ; III, 197, 201], ... the surveyor in the mountains, far distant from the Presidency, finds himself...liable to forfeit his allowances. ...

By the regulations all surveys are to be discontinued during the rainy season, ... but it is in that season alone, when the snow is to a certain degree melted, that we can best explore those deep recesses of the Himmalya where the rivers originate. Nothing but...necessity... would tempt the surveyor to keep the field at a season...[of] more than ordinary exposure, fatigue, and danger[3].

Respecting my survey bills when with the Reserve. The Deputy Military Auditor General stated...that I am...entitled to the allowances of 100 Rs. a month, being those of an officer deputed to keep the minutes of a route. ... If entitled to allowances, I conceive it is to those I have always received as a surveyor, viz., 618 rupees a month. ...

There is a great difference between what is required from an officer...deputed by his commanding officer to keep the minutes of the route...and from an established surveyor with the very best instruments. ... Without routes we cannot move; ... when such are corrected by astronomical observations they become most valuable and important. The mere keeper of...a route cannot make such corrections ; ... his allowances of 100 rupees a month would barely in three years amount to a sum sufficient to purchase merely the chronometers I used[4].

Hodgson's difficulties were very real, for he had to meet all the expenses of the survey. Herbert, moreover, who was now doing most of the actual work owing to Hodgson's ill-health, writes that the retrenchment had reduced him

to great difficulties. Since the latter end of March last, I have been...expending on an average

[1] DDn. 64 (67), 25-10-17. [2] DDn. 152 (45), 22-5-18. [3] ib. (51), May, 1818. [4] ib. (56), 4-7-18.

200 Rs. a month, or indeed more. ... I have not received from the Paymaster any part of this very considerable sum. Besides this, my personal allowance has been refused payment since December last inclusive, amounting to 1,000 Rs. for ten months, ... a total sum of Rs. 2,425. Of this, Rs. 560 is absolute loss, being the amount of the emoluments of my Company which I relinquished when I left my corps to join this survey.

Difficulties have increased so fast upon me that I should long ago have been forced to... resign, ... had not my friends...furnished me with funds to meet the current expences. ... I am indebted so largely now to individuals, in consequence of the long stoppage of my allowances, that I am really under the greatest difficulties as to how or where I am to obtain funds[1].

In a later letter he urges his claims to succeed Hodgson in charge of the survey, and draws attention to the very small salary

granted to assistant surveyors, being only an addition of 50 Rs. to what an officer would enjoy with his corps. ... This sum would never...induce an officer to embrace a line which is...ruinous to the health. ... Such an allowance is not an adequate remuneration for the exercise of that skill and knowledge which a surveyor...may be supposed to possess ; or even for the...constantly moving about, besides the discomforts and expence attending a life continually passed in the field, and without any fixed habitation. ...

I was actuated by a strong bias towards geodetical pursuits, as well as a natural desire to have my name connected with Captain Hodgson's in...his very interesting task—the measurement of the height of the Indian Andes. These motives...would have...retained me in this ill-paid situation, had he continued in the direction of the survey, but his appointment to another situation gives me, shall I say, a claim to look forward to some remuneration[2].

Some relief was afforded by the issue of special orders for the speedy payment of surveyors in the hills. This did not, of course, cover the case of Hodgson's allowances for the time he was absent with the Reserve Army, and these were not passed till the maps and fieldbooks were properly countersigned by the Surveyor General [I, 197 ; II, 217]. He could not, however, draw the special hill allowance of Rs. 200 for that period[3]. Even as late as December 1820 his full claims had not been settled because he had not complied in full with "established rules"[4].

Difficulties arose over the allowances for assistants in the Quartermaster General's Department, who were to draw their special departmental rate as A.Q.M.G. even when serving under the Surveyor General [334–5]. Hugh Morrieson, working from boats in the Sundarbans, was no longer entitled to extra allowance as River Surveyor [346] "because of the permanence of the salary in the Quarter Master General's Department", which made no provision for the hire of boats, Rs. 240 for each boat per month. He was eventually paid on submitting contingent bills countersigned by the Surveyor General[5].

Because the permanent allowance of Rs. 400 p.m., made no provision for the supply of instruments, Franklin submitted a colossal indent which the Surveyor General could not possibly meet, and it was then ruled that these surveyors should "draw the established allowance of 618 rupees per mensem, to enable them to supply their own instruments" [211][6].

For Jackson's road survey to Nāgpur [27–8] Government agreed that an A.Q.M.G.'s allowance could not cover all expenses, and authorised the payment of Rs. 2,150 as compensation for the loss of three elephants which had "been employed for the conveyance of the sick through the wild and unhealthy tract"[7].

Under a ruling of 1811 it was laid down that survey allowances might only be drawn for periods of actual survey duty [II, 327]. In 1823 Hodgson, remembering his own case of 1818 [347], asked that surveyors should not only be allowed reduced allowances during temporary absence on medical certificate, but even full allowances if "able, in hopes of speedy recovery, to remain sufficiently near to afford a general superintendence from the nearest station"[8]. Government did not accept the latter suggestion, but agreed that in the case of "sickness duly certified by a medical officer" a surveyor might draw Rs. 250 a month when "temporarily...proceeding

[1] DDn. 152 (11), 4–10–18. [2] ib. (100–4), 11–7–19. [3] DDn. 144 (59), 12–2–19. [4] DDn. 145 (577), 8–12–20. [5] DDn. 142 (83–7) & BMC. 3–5–17. [6] DDn. 145 (105–8), 25–2–20. [7] DDn. 191 (221), 6–7–21. [8] DDn. 198 (171–3), 22–1–23.

to distant stations, on the river or otherwise"[1]. This concession was later extended to sea voyages on Hodgson representing that there were no officers

whose duties are so fatiguing and so detrimental to health as those employed in land surveys, and the diseases incurred by constant exposure to the sun must generally be of a nature which voyages to sea, or to the Cape, are most likely to alleviate. ... No officer would wish to leave his duty to proceed to the Cape on reduced allowances, and at a very heavy charge for passage money, unless compelled by the strongest necessity[2].

Special permission was obtained for Wilcox to draw full allowances at Sadiya during the rains, after his strenuous tours across the hills in 1826 and 1827,

on the plea of...having been assiduously employed, not in the...comparatively light labour of finishing plans, ... but in eliciting information for...those countries which we cannot expect ...to visit. ... My few leisure hours were occupied in acquiring a knowledge of the Assamese language to fit me better for my duties of this season[3].

By a further concession he drew full allowances whilst at Calcutta during the rains of 1828 that he might work more efficiently than in an Assam boat;

He was directed...on his way down to make certain surveys of part...of the Burmahpootra. He...arrived in Calcutta on the 12th June last, since which time he has been assiduously... employed in my office in constructing a valuable map of the course of the Burmahpootra from Goalparra upwards as far as he could penetrate, and of the country and rivers of Assam generally, and of the contiguous mountains [64]. ...

The surveyor...is of course at much greater expense at Calcutta, where he is obliged to hire a house, and also to keep up his pinnace and boat establishment, that he may be ready to return to his duty on the river when ordered ; for...in Assam the surveyors live in their boats, which are their own property. ... I trust that Lieutenant Wilcox will be considered fully entitled to his salary and boat allowance during the present season[4].

Special authority had to be obtained before Burlton could draw any survey allowance in Upper Assam [60], the Surveyor General writing that

on the 8th September last Lieutenant Burlton was selected by the Commanding Officer in Assam to accompany Lieut. Wilcox on a survey. ... I do not know of any case similar to the present. Officers have indeed...been allowed to accompany surveyors on journeys of difficulty and interest, but for their amusement only. In this manner Captain Raper accompanied Lieutenant Webb on a survey in the Himalya mountains [II, 74], but I am not aware of any allowances having been required in such instances. ... Remuneration might be granted for the time he was actually employed...and put to extra expenses. ... Tho' not appointed an assistant surveyor, the duties...must...be of a nature not very dissimilar[5].

Burlton was granted allowances of an assistant surveyor with boats, and continued to draw Rs. 300 a month till his tragic death [64].

The appointment of surveyor on special terms often raised awkward problems for the accounts department, and the Surveyor General was questioned by

the Civil Auditor respecting Mr. Bedingfield's allowances. In the very general terms in which he was appointed, ... no mention was made of his allowances, and they must now be ordered, as auditors do not go but on precise orders and sure grounds. ... I hope Mr. B. will be placed under Mr. Scott's immediate orders and payment, as he is best able to direct him [64]. ...

You must remember in making your bills that the Auditor passes but does not pay them. ... If you wish them paid here you should address them to the Sub-Treasurer. When any establishments are charged for, the authority ought always to be quoted, and date for the order. ... It is very well for powerful...Secretaries to get sweeping orders passed, but when you go to Paymasters and Auditors, an authority is required for every rupee[6].

In spite of allowances which looked so liberal on paper, a surveyor's career was hardly a business proposition ; they had to provide

their own establishments and instruments, and these are very costly, ... and several of the most ambitious have in their private possession some of the most valuable instruments which can be made in England. If the surveyor is sick or otherwise interrupted in his work, he loses his allowances during the time it is discontinued [347, 356], and altogether he cannot be deemed to be over-rewarded for a life of solitude and almost unassisted toil[7] [II, 327–9].

The salary fixed for the Revenue Surveyor General in 1823 was Rs. 1,200 a month, with Rs. 350 for office rent [306]. The revenue surveyors drew the standard

[1] BMC. 30–5–23 ; DDn. 197 (62). [2] BTC. 10–7–23 (30). [3] DDn. 204 (302–3), 14–12–26 ; 219 (35), 12–1–27 ; 219 (235) 1– & 24–8–27. [4] DDn. 231 (175–8), 29–9–28. [5] DDn. 204 (304), 6–2–27. [6] SG. to Wilcox, DDn. 220 (281), 28–9–27. [7] from Hodgson, SG., 9–3–22 ; DDn. 198 (31).

salary of Rs. 618 for nine months of the year whilst their officer assistants were allowed Rs. 250, as "the allowance to an Assistant Surveyor employed in geographical survey is...too small for the arduous duties to be performed"[1].

MADRAS

The salary for surveyors in Madras had been fixed in 1801 at 100 *pagodas* a month [II, 230], which included the second half of *batta*, and pay of lascars. The allowances recommended by Mackenzie in 1816 were more generous in that they allowed the ½-*batta* and pay of lascars to be extra ;

In consideration of Lieutenant Ward's employment as Assistant in this office since 1810, in addition to his experience in the surveys of Canara and in the Ceded Districts, ... he should be allowed...the full allowances of a Surveyor, ... viz., 100 pagodas per month salary, with one Tindel and 6 Lascars, and the additional half batta of his rank. ... When a Surveyor does his duty in this laborious service, this is no more than an equitable compensation. ...

Lieutenant Garling's salary was fixed on the 5th February 1813, inclusive of all expenses excepting lascars, at 150 pagodas per month [II, 332]. ... I...recommend that a tindel be added ...extra to the lascars allotted...by regulation[2].

Two extra lascars allowed to Garling were "on account of a superior instrument which he used" [II, 158]. Ward was allowed the extra *tindal*.

Survey allowance for Engineer officers still remained at 37½ *ps.*, the old rate based on ten shillings a day [I, 279 ; II, 330 n.3], and this was all that Davies drew when on survey in the Deccan in 1817 [II, 393][3].

Allowances were not cut during the rains, and Mackenzie writes from Bengal ;

All surveyors' allowances are strictly laid aside here during the rains, & only 250 Rs. allowed p.m. ; the...allowances are better than ours (except Mr. Garling's), but the instruments are defrayed by the surveyors, & when they get any from the public stores, they must be paid for[4] [II, 221–3].

In 1821 Ward drew—in addition to regimental pay [I, 279 ; II, 330]—personal salary Rs. 350—difference of full and half-*batta* 67–13–0—surveying lascars 70–6–3 —total Rs. 488–3–3 p.m. From 1818 he drew a further temporary allowance

for his extra employment in Travancore in the investigation of the limits of Tinnevelly and of the Cardomom Mountains...—175 rupees per mensem—...for the surveying season only and when actually employed on field duty, ... eight months in the year[5].

When Conner was posted to the Hyderābād survey he was only allowed the standard 100 *ps.*, or Rs. 350, which he had drawn in Coorg and Travancore, and not the higher rate sanctioned for Garling[6]. The standard rate covered all items provided for under the old regulations, viz., "office rent, horse allowance, interpreter's allowance, etc.", and Mountford refused to forward Young's application for rent of an office as he thought it the duty of the officer in charge

to provide a suitable commodious and safe house for the deposit of the public property, ... and on no account to permit the maps, etc., to be kept during the monsoon in a tent, where they are so liable to be injured or destroyed[7].

Young was allowed the higher rate after protesting that

the duties expected of me are not less arduous than those of my predecessor ; and the number of assistants being greater now than formerly, the sphere of those duties is consequently enlarged in proportion. ... It is well known to you how materially different the situation is to me to what it was to Captain Garling ; the liberal aid afforded to that officer by the Nizam's Government in the prosecution of the survey has been withheld from me [417–9]. ...

The duties of a surveyor in these territories, if not more arduous, at least require more vigilance, and are attended with greater expenses than similar duties are in our own districts[8].

Snell's salary in the Circārs remained at Rs. 350, and his application for an increase was met by Mountford's unsympathetic comment that

higher salary is merited by work requiring higher qualifications, or...greater expenditure on

[1] DDn. 204 (307), 2–3–27. [2] MPC. 437/1816, 10–5–16. [3] DDn. 151 (13), 3–8–17. [4] DDn. 156 (293), 18–8–17. [5] from Mountford ; DDn. 192 (74–6), 21–2–21. [6] DDn. 194 (70), 26–4–22. [7] DDn. 192 (276), 25–10–21. [8] DDn. 194 (72), 18–4–22 ; (131), 16–8–22.

the part of the individual. Under the latter view I don't comprize any expenses to be incurred for "raising mounds and cutting down timber to get a distinct view". ... If the work is very trying, the lascars...may perform it; if heavy, it should be provided for by bills on honour, and, in that case, a previous view...should be submitted to Government for their sanction[1].

Snell made another effort, again pressing the absence of Lambton's triangulation through the Circārs, which entailed extra work for building high mounds and clearing hill-tops [339]. Although this was supported by Montgomerie, Government refused to consider it, but permitted both Ward and Snell to "submit statements of the actual charges incurred...for work beyond what their authorized establishments of lascars were adequate to perform"[2]. This rule was also applied to the Hyderābād Survey when Morland took charge in 1829[3].

The staff salary allowed to Riddell as assistant in charge of the office at Madras was 70 *ps.*, being that of officers of the first class of the Survey Branch of the Q.M.G.'s department. For Mountford this was increased to 100 *ps.*, or Rs. 350, as for field surveyors. On the upgrading of the post to Deputy Surveyor General, the salary was increased to Rs. 500 [320].

The survey allowance of a military officer holding the appointment of assistant surveyor was Rs. 122–8, the same as for a civilian assistant promoted from sub-assistant, but extra to regimental pay and allowances. From December 1829 the military assistants had their salaries raised to Rs. 180 a month as soon as they were reported fit for survey duty[4];

The object for which young officers were recommended as Assistants to officers in charge of provincial surveys having been more with a view of their acquiring a perfect knowledge of the duties of surveyors than the expectation that much benefit could be derived from their services for some time after their appointment, the small monthly salary of 122½ rupees... could only have been intended to cover the extra expense to which they are liable...in the field, and could not be...a sufficient remuneration for officers capable of performing the very arduous...duty of surveyors[5].

BOMBAY

The salaries of surveyors in Bombay were fixed quite independently of those of the other two presidencies.

The personal salary drawn by Williams as Surveyor General before the abolition of that post had been Rs. 702 p.m., in addition to Rs. 500 as Revenue Surveyor, or "member of the Committee of Revenue Survey", and Rs. 250 establishment allowance, amounting in all to Rs. 1,498 p.m. [II, 325]. In his protest against being superceded by Hodgson as Surveyor General of India in 1821 [322], he pressed for the recoupment of all his private expenditure on the preparation of geographical maps since 1815. The Bombay Government granted him a monthly establishment allowance of Rs. 80 for the whole period, and asked the Directors to authorize a further allowance of Rs. 700 a month, equivalent to his former salary as Surveyor General. This the Directors cut to Rs. 200 [322].

On his appointment to charge of survey of the "Northern range of Ghauts" in April 1816 [122][6], Sutherland was granted a salary of Rs. 500 p.m., that was continued when he was given charge of the regular survey of the Deccan, "which" writes Elphinstone, "does not appear adequate to so extensive a charge"[7]. This same salary was continued on his appointment, first as Assistant, and then as Deputy, Surveyor General [323]. He was disgusted at not being given any increase of salary to meet increased responsibilities, but his appeal to the Directors after his return to England, was sternly rejected[8].

Rates of pay for assistant surveyors varied considerably. The standard rate for a junior assistant was Rs. 4 a day, but Engineers drew Rs. 262 a month. On

[1] DDn. 220 (15–7), 28–1–24. [2] MMC. 21–10–28; DDn. 222 (341). [3] DDn. 237 (173), 24–7–29; 239 (188), 2–10–29. [4] DDn. 237 (123), 1–12–29. [5] from DSG.; DDn. 328 (2–3), 9–10–29. [6] Bo Pol C. 11–4–16. [7] Resdt. Poona to Bo. Govt. 6–12–18; DDn. 144 (111). [8] CD Misc. 66/1133 18–5–27.

the Deccan survey no previous agreement had been made as to the pay of the surveyors lent from Madras, which led to considerable inequality

in the allowances of the Assistants in Major Sutherland's survey, from the officers belonging to different establishments, and to different branches of the Army. ... I am not certain what the Madras allowance...is, but I believe it is about 75 pagodas, or 262 Rupees[1].

No settlement had been reached a year later and Sutherland pointed out that

Captain Challen...has performed the most useful duties on the allowance usually granted to officers employed in taking routes, viz., 120 rupees per mensem ; the other officers have no staff salaries. The case of Captain Boles and Lieutenants Perry and Montgomerie is peculiarly hard. ... They have not only been without any allowances whatever, but have absolutely incurred considerable expense out of their private funds. ... As these gentlemen belong to the Madras Presidency, they might be paid...according to the regulations of that establishment[2].

It was decided eventually that all assistants on the Deccan Survey should draw the rates allowed on the Gujarat revenue survey ; 1st Assistant, Rs. 300 ; 2nd Assistants, Rs. 250 ; and 3rd Assistants, Rs. 120 p.m.

Engineer officers when appointed

to the charge of fortresses, or employed in the Superintendence of Public Works, on Surveys, are entitled to drew the extra personal allowance of their respective ranks, viz.—700 Rs. per month to a Field Officer—420 Rs...Captain—262 Rs....Subaltern—and then only during the time of their actual employment[3].

On his survey of Kāthiāwār [127–8], Slight drew staff pay Rs. 500 p.m., the same as drawn by Jopp in the Deccan. Jervis, also an Engineer, asked for his allowances to be increased to the same as Slight's ;

	Lieut. Slight	Lieut. Jervis
Staff Pay	500–0–0	300–0–0
Full batta	120–0–0	120–0–0
Tentage	66–3–0	66–3–0
Gratuity	24–0–0	24–0–0
Nett Pay	62–0–0	62–0–0
Establishment	290–0–0	412–0–0
Grand Total	1,062–3–0	984–3–0

Jervis was told to wait ;

The extensive Department of which Captain Jopp is at the head [Deccan survey] constitutes a much stronger claim to high allowances than...any single survey. The allowances of Lieut. Slight were fixed at a high rate in consequence of the expected short duration of his employment. As a general rule, however, the salaries of such appointments must...be regulated by the duties, and not by the...abilities, still less by the standing, of the officers employed in them. ... The Governor in Council thinks it necessary to record his dissent from the principles advanced by Lieut. Jervis. He is sensible of his zeal and ability and...statistical enquiries... will...decide on...some separate remuneration for that duty when it is completed[4].

GREAT TRIGONOMETRICAL SURVEY

Lambton's survey salary at the time of his transfer to the Supreme Government was 400 *pagodas*, equal to 1,400 Madras, or 1,300 *sicca* rupees [II, 335 ; III, 324]. Everest and Voysey were both appointed with salaries @ Rs. 600 p.m.

On his journey from Chunār to Hyderābād [271], Everest of his own accord made a survey of his route, 750 miles[5], and finding that he had no time to protract it, asked that he should be allowed "an adequate salary" for the period of the journey, to cover the pay of draughtsmen who should map it under his supervision. His application was referred to Mackenzie, who commented ;

It is a fixed principle with me that labour and meritorious exertions ought to be well paid. Work well and pay well [t-page]. The rules of the service have provided for this to an extent that has been generally admitted, encouraging to officers of the rank of Subalterns and Captains. In extraordinary cases Government have always exercised their undoubted privilege to discriminate...and to consider particular cases with liberality. ...

[1] from Elphinstone, 31–3–19 ; DDn. 144 (181). [2] DDn. 145 (171–4), 4–2–20. [3] Bo GO. 31–3–19 ; Bo MC. (camp), 59/1822 ; note by MAG., 28–10–22. [4] ib. 137/1824 (187) ; 28–9–24. [5] 7 sheets, MRIO. 63 (10–6).

When officers or other individuals have not been specially appointed to any survey, and not provided with any fixed stipend, it has been the practice that...the results of their observations have been presented to Government, who...have awarded sometimes the full Surveyors' allowances...for a reasonable period; in other instances a round sum as a compensation. ... I have experienced myself the liberal consideration of Government repeatedly, and know that others have been allowed time to complete their work, and have received...compensation. ...

In Captain Everest's case, ... he is allowed...salary as assistant to the Trigonometrical Survey, which I consider him entitled to from the day he left the Telegraph duty to join Colonel Lambton. ... This is, however, contrary to the custom that prevails here, but not at Madras, that the surveyor draws not the allowance till he commences the survey. ... No precedent whatever exists of a salary and surveyors' allowances being both drawn by one person.

On Captain Everest's relinquishing the Telegraph duty by order, and leaving Chunar, he applied to me for instructions to survey, but I did not consider myself warranted to issue any instructions to Captain Lambton's assistant, both from an idea that the principal routes to Hyderabad by which he would travel had been already surveyed, ... and my...instructions might have interfered with the material object of his early joining his Principal. ...

It appears that Captain Everest has availed himself of this occasion to survey the route, to take observations and to ascertain heights etc., but unfortunately he has not protracted his work. ... I am aware that...it is difficult to protract the work from day to day, and I have myself usually allowed the 3rd or 4th day for this [201]; the field books also should be wrote in such a way that they may be protracted afterwards, if sickness or accident, as is too often the case, should prevent the surveyor doing it early.

Captain Everest proposes...at the utmost to calculate the latitudes, and give a general superintendence to the construction by some other. ... Tho' I think a draughtsman might be useful...in writing names, I have never known the protraction of the field work left by the Surveyor to other hands...—it certainly requires some knowledge of the details...to lay down the work of another by protraction—I have never known an instance of it. ... Colonel Lambton's opinion should be referred to, both of the benefit of the work, and for the aid which his establishment might give[1].

Everest had no opportunity to protract this survey, nor any special reward; on the other hand he drew full pay as Assistant in the Great Trigonometrical Survey from the day he left Chunār, 16th October, to the day he reached Hyderābād, 26th December. He tidied up his fieldbooks and put them away till his return to India in 1830, when he passed them to the head draughtsman for protraction. It was not until 1840 that he submitted the resulting map to Government[2].

There were special rules regarding private house rent, and special sanction had to be obtained for drawing of office rent. During his visit to Calcutta in 1825 to close the affairs of the survey before proceeding on leave, Everest tried, without success, to obtain rent for a house in which to put the records

of my department in as intelligible shape as I could; ... without resorting to it I could not have superintended what was going forward on the part of my subordinates. The house which I have hired costs me 225 Rs. per month. ... I have never yet drawn any allowance, or made any charge for house rent, but have always dedicated the greater part of my own bungalow, or one of my best tents, to the purposes of an office, thereby renouncing all pretensions to individual comfort [256][3].

Whilst Government rejected this claim, they allowed house rent to Olliver;

His Lordship in Council considers the claim advanced by Captain Everest for house or office rent altogether inadmissable. With respect to the application submitted by Mr. Olliver for a house rent, ... with reference to the expenses of a residence in Calcutta, and the great difficulty of procuring any suitable accommodation on terms more moderate, His Lordship in Council authorizes him to draw a monthly allowance of 70 rupees for a house[4].

FIELD BOOKS & JOURNALS

Under regulations which dated from 1796, every surveyor had to send in a monthly progress report to the Surveyor General, together with copies of fieldbooks

[1] to Mil. Sec., 30-1-19; DDn. 154 (66). [2] DDn. 402 (23-4), 17-4-40. [3] DDn. 171 (403), 9-9-25.
[4] DDn. 201 (157), 14-10-25.

and journals. Without the Surveyor General's certificate that satisfactory work had been done, the Military Auditor General could not pass any bill for surveyors' allowances [I, 197 ; II, 217–20][1].

Time after time various Surveyor Generals had issued detailed instructions regarding the preparation of fieldbooks, and protested against delay in their submission, or slovenliness in their preparation[2] [II, 219–20], and Mackenzie was horrified on his arrival in Bengal in 1817 to find that, since Crawford's departure, these regulations, amongst others, had been but little heeded [290]. Though the surveyors pleaded special circumstances, and gave plausible excuses, yet he was far too conscientious to allow any relaxation of rules. So long as fieldbooks or regular journals, or the resulting maps, failed to reach him, he would not certify that any useful survey had been accomplished.

The surveyors pleaded that it was more important to get on with the work than to sit down and make copies of fieldbooks—their original books could not be sent in because computations and protractions had not been completed—no maps could be drawn until the triangulation had been adjusted to the astronomical observations—they were entitled to full allowances right through the rains because that was the only period when field work in the mountains could proceed—it was most unfair that the Paymaster should withhold payment and leave the surveyors to make vast payments from their rapidly dwindling private resources [347–8].

All this was true, but Mackenzie protested firmly when Hodgson handed over to Herbert after working nearly three years without sending in a single map ;

The Surveyor General is expected to call on all surveyors relieved from that duty for the materials of the surveys [II, 218–9], and in this case no materials, maps, sketches of the work, excepting field books, having come into the office...he deems it expedient, ... both for the preservation of the materials of a work that has lasted three years, and to enable him to perform his duty...of the general direction, ... to solicit his Excellency's instructions whether this survey is to be further carried on to its conclusion, and by whom it is to be executed. ... Considering the distance from hence, the difference of the seasons of the country, and the interest that the survey of the countries towards the heads of the Ganges may excite [II, 84, 89 ; III, 46–8], he would...suggest...measures being...taken on the subject. ...

From all these surveys, none of those communications...that have been usually furnished both in this Presidency and in Madras...are now sent in to this office. From the survey of Benares [II, 36], that of Kumaoon [44–8], that of Sirmoor [29–37], that of Bundelcund [81–2, 303–4], no plans, maps, or sketches. I do not mean to find fault with this, as there may good reasons for delaying them ; but how is it possible for me...to offer any propositions on these particular surveys without I have materials to go on ?

...From Captain Hodgson's side...even the field books are either delayed...or unintelligible —the only check I have on the surveyors[3].

He consulted Thomas Wood [II, 457 ; III, 300] as to the regulation which requires surveyors on closing a survey, or on being relieved from one by sickness or removal to other duties, to deliver over all the materials...to the Surveyor General, and what is intended in this ; the maps, plans, notes, and journals, I presume. ...

We have, or are likely to have, two or more removals, ... and as I do not find that this rule was practiced of late (I mean in Colonel Crawford's time), I am unwilling to take it up without I find it was expected. Yet I certainly see the benefit of it, and that when a survey is to be continued all its former proceedings ought to be forthcoming. ... I would not like to propose anything unusual or harsh, and I am always an advocate for giving ample time to surveyors ; on the other side it is necessary to secure my own side[4].

Mackenzie still refused to give Hodgson the certificates necessary for his allowances, not accepting his fieldbooks alone as sufficient, and Hodgson writes bitterly ; Having been long suffering from ill health incurred in the prosecution of my duties in the mountains, I am ignorant whether any, and what, report respecting my field books from February to the 10th August 1818 has been made. ... Conscious of having always done my duty to the utmost of my powers...I am not aware of any solid objections that can be made to my field books. ... If there are such, I respectfully entreat that...the field books may be delivered to me, that I may submit...such explanation as I think necessary. ...

[1] *BM Regs.* ch. 65 ; BMC. 15-8-1796. [2] BTC. 3-7-23 (70). [3] DDn. 154 (28), 16-10-18. [4] ib. (39), 21-10-18.

It may perhaps be objected...that...the greater part of the observations recorded...were not made by me personally, but by my assistant Lieutenant Herbert. That such was the case I have explained to the Surveyor General [303]. ... What observations I could make myself were few and interrupted, but those made by Lieutenant Herbert fully justified the high opinion I entertained of his ability and, ... being made at the places and in the manner I directed, I consider myself answerable for them, and I examined them as soon as my sight would allow, and inserted them in the field books which I signed [347]. ...

An Assistant Surveyor is not required to send in field books, as I understood from Colonel Crawford, who forbid my doing so when I was an Assistant Surveyor, informing me that the duty of an Assistant Surveyor was to assist his Principal as the latter might direct[1].

Government supported Mackenzie ;

During the months of February and March 1818, Captain Hodgson remained at Kurnaul in consequence of indisposition, and, ... although during the following months...he was on the mountains on the field of his survey, he was still prevented by ill health from taking an active share in its prosecution. ... The operations comprehended in the field books for those five months were performed by his assistant Lieutenant Herbert.

His Excellency in Council would not...insist upon a minute account of the manner in which the operations...have been divided between the Surveyor and his Assistant; but to enable the Surveyor General to exercise that controul over surveyors which is...one of his principal duties, ... all surveyors should furnish him with regular reports...to shew that their services have been given to the survey, and that when the Assistant is separated from the Chief Surveyor, the former's field books, under his own attestation, should be regularly transmitted in addition to the field books or other reports of the principal surveyor. ...

With the exception of the field books and the small sketch forwarded by Lieutenant Herbert, no...materials...have been received in the...office since the institution of the survey in October 1815. ... His Excellency...would not be justified in admitting Captain Hodgson's claims...until the documents...shall be forthcoming. ... The delay in the adjustment of that officer's survey accounts cannot be justly ascribed to any unnecessary procrastination in your office, but to Captain Hodgson's irregularity in not furnishing the plans...of his survey, and to his omissions to reply satisfactory to your references. ... Those requisitions seem to have been made by you with every degree of consideration for Captain Hodgson's peculiar situation. ...

Government is of opinion, 1st., that Assistants...should keep field books, and that they should be forthcoming at the requisition of the Surveyor General; 2ndly., that the field books should be kept monthly, both by the Surveyor and his Assistant[2]. ...

Hodgson protested against the suggestion that he had not given ample evidence of the progress of the survey, even though no map had been submitted ;

All my field books, ... are deposited in the Surveyor General's office. They are digested and compiled from the rough notes taken in the rain and snow, so as frequently to be hardly intelligible to any but the writer. When I have had leisure I have generally, in my own convenience, reduced these notes into a more distinct shape, and copied them, perhaps with more explanations, and sent them as the field books to the office.

Not expecting to be called for, these rough documents...are interspersed...with miscellaneous matter of tentative calculations, ... and Tables copied from scientific works on astronomy and geodesie. Many of the notes are in small books, almost illegible, ... and from having been wet perhaps they would be unintelligible to any person except myself. ... My only wish to retain them...is to assist me in...completing the ultimate calculations and great map with Lieutenant Herbert, if we should be allowed to meet for that purpose. ...

I communicate with Lieutenant Herbert frequently with regard to the map. ... It went on gradually, and was in progress, as will appear from a reduced copy which was sent down. I was ordered by the Surveyor General to send such a one on a small scale. ...

Surveyors were, in the mountains, frequently obliged to take the field in the rains, tho' contrary to the regulations. ... Much must rest on the discretion of the surveyor, for those employed in the mountains had every inducement to finish their wide extended field of operations as soon as possible, consistent with accuracy. I never was ordered to send in any part of the map in detail, or I would have done so, but I wished to present nothing till the whole should be finished, as Colonel Crawford advised me, and a variety of reasons convince me is the most eligible plan in an extensive and difficult mountain survey[3].

Government held to their previous orders, replying that Hodgson's zeal and professional ability has not been called in question. ... The protraction of the survey for...forming a proper map of the tract surveyed must be deemed the principal object of the

[1] DDn. 144 (157), 6-4-19. [2] to SG., ib. (299), 27-8-19. [3] DDn. 145 (53-74), 12-12-19.

undertaking, and...this...has not been commenced. If any accident had befallen you...this main object must have been entirely defeated. ... His Lordship in Council entirely concurs in the expediency of your...commencing the protraction, ... and the Surveyor General will be immediately consulted upon the proper period for allowing Lieutenant Herbert to join you. ...

The Governor General...regrets that he cannot sanction the payment of your bills, until he shall be assured of the work...being in a satisfactory progress towards completion[1].

Hodgson and Herbert accordingly met at Sahāranpur during the rains of 1820, and the completion and submission of the long awaited map brought Hodgson his much delayed allowances [348 ; pl. 5].

Mackenzie was equally firm with Webb, who produced lengthy reasons why his fieldbooks were not entered up day by day with the date entered against each day's work. Mackenzie was adamant, and Webb drew no allowances until two years correspondence had produced satisfactory explanations. Webb pleaded that surveys in the mountains should be continued...without interruption throughout the year, and ...a certain number of days should be allowed in each month for...bringing up the map. ... If you...call for an account of *each day's procedure* it must not be considered that a long succession of rainy days...are liable to be struck out, ... though they should even amount to a whole month, because such occurrences are not under one's control, and it is impossible to discharge the establishment of carriers, ... or for the Surveyor to strike his tent and make holiday among friends till fair weather returns.

No person would undertake the fatigues, risks, and exposure, of those alpine journies, with the chance of being fined in the amount of his establishment when the weather may prove unfavourable. ... It is...under such cases...that you...notice a *deficiency of dates* in my field books, and that there is an unwillingness to furnish a *daily report*. The department ...is the only one...which deprives its officers of their salary in cases in sickness. ... As the object of the regulation is evidently to check indolence, ... the Surveyor General should be able to dispense with the services of such as he might find negligent[2].

The regulation upon this subject originated...with Colonel Colebrooke [I, 169–7, 278], and was drawn up with a reference to ordinary surveys which comprised only perambulator measurements and no calculations except for latitude, the result of which alone was entered in the field book. I officiated for some time as Colonel Colebrooke's assistant in the field [II, 31–2, 453], and...it was his own practice, and his advice to me, ... to perform as much field work in two or three days as would, when fairly divided, occupy three or four days in the field book, and thus give a leisure day for...protraction, ... without the appearance of a halt. ...

In an ordinary survey there is no difficulty in arranging the field book into "days' work", because it is absolutely impossible to discover whether a given measurement was made on the 1st or the 5th of the month, and...perhaps...of no great consequence. But in my survey... there are numerous calculations which cannot be examined unless the actual date of the observations...be truly exhibited. ... When the atmosphere is clear...I do not pause to complete calculations, but pursue my work abroad without intermission and, if this continue for three weeks, the computations in arrear require, perhaps, intense application for a fortnight. ...

Having now laid before you, without the least concealment, the exact difficulties which occur, I trust you will...sanction the omission of days in the route book (where they are not essential). ... It is my intention to continue to transmit to you a monthly journal, ... but... the dates cannot, I fear, always correspond[3].

Mackenzie did what he could. He sent Webb an assistant [48] ;

I have also got these Mountain Surveyors relieved from sending the monthly field book till their leisure, on the simple condition of sending a monthly return of their proceedings. ... As it is regulated now, Mr. Webb and his two assistants[4] will be paid monthly by the nearest Paymaster. The field books will not be required till he thinks it convenient to make them up, but he must be exact in sending a monthly report of progress.

There were, however, still difficulties over reports, and delays in payment of allowances, and Government supported Mackenzie in refusing his certificate because Captain Webb's field books were dated merely from the 1st of June to the 1st of October, and contained no intermediate dates to distinguish the progress...during the interval. ... You had recommended Captain Webb to bring this case before Government himself, but...Captain Webb has neither followed that course, nor furnished any explanation of his having omitted...intermediate dates.

[1] DDn. 145 (77), 4-2-20. [2] DDn. 150 (53), 8-10-18. [3] ib. (83), 31-12-18. [4] Tate and Laidlaw [266–7].

Captain Webb should be again called upon to furnish an explanation. ... On receipt of such explanation, you will again...submit...your sentiments as to the expediency of passing the bills...which are in the meantime to be suspended[1].

In spite of his strict insistence on the regulations Mackenzie was by no means without sympathy, and writes to Grant in Gorakhpur [20–2];

I wish all success to your laudable efforts, & need not recommend your complying with all regulations to the letter. There is no intention to annoy surveyors unnecessarily. I am aware of all the inconveniences...& so far as I can will support what is reasonable. My maxim is that "the laborer deserves his hire" [352], but I am also an advocate for regularity & for conforming to the regulations that Government consider necessary for reasons that cannot be always understood or communicated at a distance[2].

and to Buxton in Orissa [17–9];

All I can do immediately for your relief is to send you one thousand rupees of my own money. Send no bills here, for God's sake; send them to your Agents. Our business is to certify the receipt of your field books & reports as being satisfactory, and the Auditor will then be authorized to pass your bills. ... Take care of Mr. Burke [17] and give him some of this on account[3].

After becoming Surveyor General himself, Hodgson had the rules eased to allow the surveyors two days halt every week

including Sunday, for the duty is extremely harassing, and sufficient time is not allowed to bring up the protraction, which is always desirable, and to make calculations. If this reasonable indulgence be granted, the surveyors, I hope, would by their exertions on the other five days render themselves worthy of it[4] [201, 353].

He was strict enough now and returned Ferguson's field books for correction

to the form required. These last notes evince more care and attention than those you sent before, and I am more satisfied with them. I have this day certified your field books ...to the Military Auditor General, and you may consequently present your bills. ...

During the rains...pay the most strict attention to the reduction of the rough notes to the proper and orderly form requisite, and duly attend to the traverses to prove the work and the circuit. Field books are frequently sent to England in the original, and I leave you to judge what a figure those you sent me, and which I return, would have made [II, 219]. ... Each month is to be separated, and...sent in at the expiration of the month. If you furnish me satisfactory field books, fairly copied for the remaining months, I will certify them.

The map which was returned to you must be reconstructed with all care, for it will undergo a rigorous examination here. It is the correctness of the scales and...protractions which I insist on, far more than the beauties of finishing; ... delicacies of that sort may be helped here. ...

Lose no time in completing the fair copies of the field books, and sending them month by month, and...pay every attention to them. They must be on foolscap paper[5].

He gives similar instructions to Pemberton, though he admits

that the service in which you are engaged is of a laborious nature, and...you have not time to complete your full and formal field books at the close of the month; in such cases an abstract...of each day's employment may be sent to me, ... it being understood that the field book shall follow at your earliest leisure. But...when you possibly can...keep your field books up to the day. You will save yourself trouble in the end, and descriptions written...at the time are much better than any...afterwards digested from short or loose notes[6].

and to Wilcox;

Journals...must be so arranged that your steps may easily be retraced, and your notes may act as faithful guides to anyone who may have occasion to come after you. They are also necessary to the Surveyor General, who must examine your maps by your daily notes, which may be made very instructive. ... A field book is a daily journal sent in monthly, and such has been the custom of the service for the last 30 years.

When I was a surveyor, I never allowed my field books to be a day in arrears. Every day was accounted for, and the surveyor was liable to, and frequently retrenched for, any day on which he was not on foot, at 20 rupees a day, Sundays excepted; now Sundays and Thursdays are allowed for halts [201]. ... You will see the necessity of your sending the monthly field books, of which copies go to the India House, and for which I may be called on at any moment by the Government here[7].

[1] DDn. 145 (83), 25–8–20. [2] DDn. 154 (43), 26–11–18. [3] DDn. 156 (157–8), 10–4–19. [4] an early example of the five-day week; DDn. 196 (151–4), 21–11–21. [5] DDn. 198 (72–3), 3–7–23. [6] DDn. 220 (207–8), 20–2–27. [7] DDn. 223 (47), 16–3–27.

On his way to Mālwa in 1827, Gerard fell ill, and for many months sent in no reports [90]. Hodgson grew even more impatient than Mackenzie had over his own delinquencies nine years before [354], and asked Government to order Gerard's suspension and removal from the survey. To Gerard he writes ;

Your communications since you left Calcutta have hitherto been most *irregular and unsatisfactory*, and have altogether disappointed the hopes entertained. ... Unaccompanied by any notes or observations, they cannot be considered of the least value. ... It is of little consequence to know that you were at places mentioned on particular days. What is required...is, what useful operations you performed, and what observations you took at those places[1].

And to Government he reported that,

from the time that Captain Gerard left Calcutta I have not received from him any account of his operations in the least satisfactory. Though repeatedly urged to transmit his monthly journals, he has not...done so, nor assigned any reason...but...bad health. ... Having failed in my endeavours to procure either journals, medical certificates, or clear explanations, ... I do not feel...that he should be allowed to take the field after the rains[2].

A belated explanation arrived too late for consideration ;

I have not forwarded the observations I took on the way from Calcutta to Agra because the late Colonel Mackenzie desired me never to send either fieldbooks or maps in the rainy weather, since a good-sized packet which I despatched at that season was entirely destroyed, and two which Colonel Blacker sent me to Delhi did not escape injury, although well soldered in tin boxes[3] [419].

It is notable that these rules making the payment of allowances dependent on the receipt of properly kept fieldbooks operated only in the Bengal Presidency. Surveyors of the other Presidencies had no such irksome restrictions, though they were expected to submit fieldbooks and journals every month, and reductions of their surveys and protractions every year. This was not so difficult when surveyors were organized in parties, but in Bengal each worked separately and often single-handed.

[1] DDn. 220 (241–2), 27–6–27. [2] DDn. 204 (332), 8–8–27. [3] DDn. 212 (309), 17–8–27.

CHAPTER XXV

CIVIL ASSISTANTS, BENGAL

Apprentice Surveyors — Special Engagements — Nominal Roll.

THOUGH in Madras there had been an establishment of locally recruited assistant surveyors since the foundation of the observatory surveying school in 1795, the employment of country-born surveyors in Bengal was definitely forbidden [II, 340–1]. No attempt was made to form a regular establishment of such surveyors until 1815, when proposals were made for extensive revenue surveys in the Upper Provinces. Mackenzie, who was still in Madras, was asked to advise how best

to organize...an establishment for the instruction of boys in the principles of geometry, mensuration, and drawing, with a view to the employment of them as land surveyors. ... The primary object...is to obtain accurate surveys of the several districts...composing the Ceded and Conquered Provinces [II, 26, 47 n.12], with a view to the permanent settlement of the revenues [149–51]. ... Exclusive of that object, it is extremely desirable to obtain surveys of particular estates or tracts of country in Bengal, etc., but a small addition to the general establishment will be sufficient for this purpose. It may be possible indeed that the duty...may hereafter be undertaken on a more extended scale, ... obtaining more geographical and statistical information than we at present possess[1].

Mackenzie offered assistance from Madras suggesting that

a certain proportion of the Native Surveyors [I, 283 n.8; III, 193 n.3] might with advantage be transferred, for a time at least, from this Presidency to...the Provinces dependent on Fort William, which...would relieve a certain proportion of the growing expense here, and...might be...an useful auxiliary measure to...establishing a seminary...for the younger pupils. ...

The primary object...being...to form an establishment for obtaining accurate surveys, ... the education and system of rearing these young people will of course be adopted to these views. ... They should be invariably employed in parties of from two to four or more under the immediate...direction of experienced, discreet, European officer surveyors. ...

As it will take some years before the young pupils can be properly put thro' a course of instruction previous to employment on actual survey, ... the number...to be first instructed ought...to be...put in a train of previous elementary instruction in writing, arithmetic, and geometry. ... By the time of my arrival at Calcutta, we should have then the seminary prepared for their further instruction. A few of the young men employed by me... (part reared under my own eye) I consider...proper persons to be usefully employed in...the instruction of the pupils as Assistant Surveyors, Writers, Draftsmen, and Calculators[2].

The Bengal Government welcomed these suggestions, and wrote to Madras that,

although His Lordship in Council is not disposed to proceed to the final arrangement...until the arrival of Colonel Mackenzie, ... still, ... to procure persons capable of affording the Collector of Cuttack assistance in the measurement of estates, and the accurate adjustment of their limits [17, 312], His Lordship in Council would wish to avail himself immediately of the service of three of the native surveyors already educated at your Presidency, in case they can be spared without inconvenience, ... to be employed in Cuttack...under the orders of the Collector of the District, and not under any professsional surveyor. ...

Colonel Mackenzie...has further...been empowered to bring round any other individuals who may be placed by the Government at Madras at his disposal[3].

As the Madras assistants were not trained in the type of detailed revenue survey required, it was agreed to wait till Mackenzie could himself bring

a limited number not exceeding 3 or 4, ... whom he is understood to have trained...to a thorough knowledge of surveying in all its details. ... Abundant employment will be found under this Presidency for persons of that class, and these are *particularly* required...as Instructors to form the nucleus of a school of cheap and able practical surveyors[4].

[1] *BRS.* (373–4), 12–8–15. [2] from SG. 13–12–15; MPC. 436/1816, 17–4–16. [3] from Bengal, 15–3–16; MPC. 436/1816 (1456–81), 17–4–16. [4] DDn. 142 (91), Bengal to Madras, 6–5–17.

When therefore Mackenzie moved up to Bengal, he brought three experienced surveyors, William Scott, who had been usher at the surveying school for many years [II, 344 ; III, 99–100], Henry Hamilton, and Marcellus Burke ; also three draughtsmen, Newman, Mustie and Gould [316]. The surveyors did not reach Calcutta till April 1818 [373–4]. Three apprentices were recruited by Riddell[1], two from the Madras Military Asylum [364], and one "from one of the schools in Vepery, ... bound as my apprentice for 7 years". He took a keen interest "to accomplish them as draftsmen" ;

I have been enquiring concerning the rates at which boys might be fed, clothed, &c. Our apprentices, at present, are very expensive in these respects, but with a greater number the charges would of course decrease. ... If a house & medical attendance be allowed, the 60 rupees you mention will be sufficient to board &...furnish paper, pens, pencils, colours & mathematical instruments, & elementary books, & to complete...the education of the lads[2].

Two were sent up to Calcutta in June 1818 [361 n.7], and, writes Mackenzie, "they seem to be fine boys. They are entirely under the care of Mr. Burke, where they will meet with every kindness".

Scott trained the apprentices ; Hamilton took charge of the drawing office, whilst Burke accompanied Buxton to Cuttack, and did valuable work till the breakdown of his health compelled him to take a year's leave to Madras[3] [17–8]. Mackenzie was disappointed in his efforts to persuade other Madras assistants to volunteer for transfer to Bengal [374].

In May 1816, three apprentices from the Kidderpore Orphan School[4] were sent to work under Gerard in the upper *doāb* [22, 157], and after the closing of that survey the two still remaining, John Graham and Simon Fraser, were transferred to Herbert's survey in the hills [38]. Gerard had used them only as recorders and copyists, and possibly for running the perambulator, for Herbert asked whether

they should accompany me into the mountains, ... being unfurnished with any instruments (except a perambulator), & the inadequacy of their salary to meet the expence of moving in the hills [346]. If they had had instruments, I would...defray part of the expence rather than that they should remain idle at a time when their services are so much required[5].

Several months later he purchased "a surveying compass & a sextant for the use of the apprentices", and put them on survey "tho' hitherto they have only been employed in assisting in plotting & drawing"[6]. Samples of Graham's surveys at this time are still preserved [39 n.9]. Fraser died at Sahāranpur in May 1822, but Graham accompanied Oliver to Delhi [155], and later had a long career as Head Draughtsman [313]. On their transfer from Gerard's survey, the Board of Commissioners debited the Military Department with the cost of their equipment ;

For Each Apprentice

Wearing Apparel ... ... Rs. 139–4–0
- A Coat
- A Great Coat
- A Jacket
- Two pairs Pantaloons
- Two Waistcoats and a Quilt

White Linen ... ... Rs. 147–15–6
- One dozen Pantaloons
- „ Jackets
- „ Shirts
- „ Waistcoats
- „ short Drawers
- „ Neckcloths
- „ Handkerchiefs
- Half dozen Stockings, Europe
- One „ „ Country
- A Hat ; 4 pairs Shoes and 2 pairs Boots.

Sundries

A Poney	
A Country Saddle and Bridle ... Rs.	72–0–0
A pair Bullock trunks, with locks and keys	24–4–0
A Camp Cot	15–0–0
A Camp Table	8–0–0
A Camp Chair or Stool... ...	1–0–0
A pair Rattan Pittaras, with locks and keys	9–4–0
A Hill Tent	100–0–0
A Necessary Tent [II, 395 n.1] between two.	

From the Futty Ghar Magazine
- 2 cases of Mathematical Instruments with colours, etc., complete
- A brass check Perambulator
- A wooden „ „

In 1817 three other boys[7] were sent to Morrieson in the Sundarbans to be

instructed and employed in land surveying. ... The necessary indentures...will immediately

[1] Macpherson, Schencks and Saxton. [2] DDn. 151 (143 etc.), 18–2–18. [3] leave from Dec. 1819. [4] The Bengal Upper Mil. Orphan School, Kidderpore, open to sons of mil. officers, warrant officers, and Surgeons. No list of pupils found later than Aug. 1799. [5] DDn. 152 (127), 5–3–20. [6] DDn. 152 (152), 7–11–20. [7] Pohill, Arthur Fitzpatrick, Clayton.

be prepared. ... Instructions will be issued...to furnish...a tent and...such surveying instruments as are requisite. Such of the necessary instruments as cannot be supplied from the Arsenal or Surveyor General's Office you are requested to purchase...and you are likewise requested to hire for their accommodation a safe and suitable boat[1].

On closing the survey in October 1818, Morrieson left these boys with the Surveyor General in Calcutta, reporting favourably on

their general good behaviour, and their attention to their duty. They have been instructed in the most useful branches of surveying...vizt. plain trigonometry, for ascertaining the heights and distances of objects—mensuration for laying down an estate—route and river surveying—the observing the working the latitude, either by the sun or a star—keeping the rate of a chronometer by observations and calculating the difference of longitude therefrom—to reduce or increase a map in copying it—to find the variation of the compass—they can also write and print the names of places in maps very neatly. Should they hereafter be employed on any duty where it will be necessary for them to take Latitudes, they ought to be furnished with good sextants, as those they have at present are bad, and not to be trusted[2].

Their indentures had now to be amended, as their original ones had been made out for service in the Sundarbans only[3]. After surveying the Sibpur botanical gardens under Scott [12], Polhill and Clayton were transferred in October 1819 to Buxton's survey in Cuttack, whilst in March 1820 Fitzpatrick was sent up to Grant in Gorakhpur [22]. Buxton's apprentices drew "allowances for apparel, food, personal servants, and accommodation, Rs. 60; tentage, Rs. 25 ; for the upkeep of a horse, Rs. 15". Regarding the horse allowance Mackenzie writes ;

I never heard of palanquins being allowed to native surveyors, and if European surveyors use them, they of course pay for them out of their allowances. In case of sickness some aid is necessary to convey the sick to medical stations, but if a permanent allowance is granted for horses, does not this provide for these conveyances[4] ?

Though described by Mackenzie as "very fine young lads", Buxton had little use for these town-bred young men ;

I can make nothing of them. I devised a mode which would enable them to live and work on their salaries, but it was extremely unsuitable to their ideas, for they tell me they cannot do without a hookah each, and their own separate servants, instead of taking one servant between 4. ... They will never be able to accompany me into the hills, as the expence of carrying is very heavy, and it would be necessary to carry provisions for their people with them into the jungles where none are to be had[5]. ... [They] will also have to procure carriage and kulassies for the instruments which they have been obliged hitherto to pay themselves. ...

I cannot say that I have witnessed in the young men...much of that...spirit of enterprise which you mention ; that total spirit of dandyism is, I take it, somewhat of a bar to the activity of the whole class. However, they have conducted themselves very well since they have been with me, and I have no fault to find...unless the want of that spirit of enterprize be excepted. ... With regard to...surveying, I have their separate portions done during the last season, which are neatly drawn and tolerably accurate ; a little practice and care are only necessary to make them fully competent to every kind of detailed surveying[6].

Clayton died during 1821, and Polhill was transferred to Rohilkhand and then joined Gerard for his survey to Sironj [89].

By 1820 Mackenzie had 12 apprentices working under Scott at Calcutta, for whom he drew Rs. 130 p.m. for house rent, and Rs. 35 each for other expenses. In January 1821 he sent eight of these[7] to Puri for field work under Scott, with Marcellus Burke doing the triangulation [19].

I have at last got a passage for Scott and his pupils, who sail this evening to be landed at Jagernaut [Puri]. ... I secured possession of the bungalow there as a kind of headquarters for Scott, who is sickly, and who will be benefited, I hope, by the trip. ...

It was some time a matter of doubt whether I should send them out to Jessore or to Orissa, but from...utility of surveying the tract between Pooree, Ganjam, and the Chilka, I determined on the latter, as Scott is in an infirm state of health, and Mr. Burke had just returned, recovered, from Madras. The latter could not be better employed for some time than in assisting in this work[8].

[1] DDn. 147 (116), 25-4-17. [2] DDn. 133 (415), 16-10-18. [3] DDn. 114 (1), BGC. 1-1-19. [4] DDn. 154 (110), 10-10-49. [5] DDn. 147 (274), 5-8-20. [6] ib. (282), 21-8-20. [7] from Madras, Mustie, Gould, MacPherson, Saxton, Schencks ; from Bengal, Dumbleton, C. H. Burke, Foy. [8] to Buxton, DDn. 154 (123), 25-1-21.

Hodgson reports later that

the party proceeded by sea...on the 26th January last, and arrived on the coast on the 3rd of February, and the young men have since been employed under the directions of Mr. Scott who...is an invalid, and it does not appear to me...that he has such control over the young apprentices as is requisite. ... I...suggest...recalling the party to this place, where the assistant surveyors and the pupils will be under my immediate controul, and be instructed as well in field operations as in drawing maps...in this office[1].

As the party was sent to Cuttack rather with a view to school exercise than to make actual surveys there, ... the ends of instruction may be on the whole better attained if the party, with the exception of one or two pupils, were sent back to my office. ...

If the institution of any surveying school should be contemplated, ... the services of the two assistant surveyors will be found useful here as Instructors. ... When the surveying apprentices were in Calcutta, they were lodged with Mr. Scott...in a house taken...for the purpose. Mr. Scott instructed them in that house, but I am of opinion that the school can be held much more advantageously in my drawing offices, where there is room for the whole party during the day, and where the instructors as well as the pupils will be under my eye and control[2].

The following notes are taken from Scott's reports from Puri ;

Mustie and Gould understand the use of the Plane Table and the Theodolite, and are now on a section which...I shall forward to you...as a specimen of their work. Their conduct... has been...very satisfactory. I intend...to set 2 by 2 in rotation with the planetable, that the whole may be qualified in sketching or delineating the true features of a country[3].

One of the boys, C. H. Burke, contrary to orders and without leave, went and bathed himself in the sea on the 19th instant, the consequence of which has been that he was laid hold of by a shark in his left arm, and would in all probability have been carried away and torn to pieces, if a wave had not washed him ashore. The wound is not so bad as would be expected ; however, I lost no time in sending him to the Sub-Assistant Surgeon...at *Pooree*, from whom I learned lately that the boy felt much pain for the first day, when it abated, and that there is every hope of his getting well in the course of 8 or 10 days[4].

The boys are getting on pretty smoothly with the survey. The whole of them now understand the use of the Plane-Table, and in some degree can delineate the features of the country to satisfaction. I shall soon begin to shew them the use of carrying on the work with the Theodolite, which I hope, their now being able to sketch, they will perform the task with greater ease and expedition than hitherto. ...

Mustie and Gould seem to behave and conduct themselves with circumspection ; they have not as yet given me any cause to reprimand them. ... As for the rest, they are wild, and seem to care little of what they are about, but I hope the lessons and chastisement which I shall be compelled to give them from time to time will make them good subjects[5].

Burke rejoined on 16th July, Scott reporting that "the wound received in the wrist joint of his hand appears to be perfectly cured"[6]. Field work was closed early in August 1821 [19], when the party withdrew to Calcutta, and was accommodated in the small house vacated by Mackenzie's translators [311].

In October 1821 Schencks and Dumbleton left for the Gorakhpur survey, whilst Macpherson and Saxton were sent up to Rohilkhand the following month. Mustie and Gould were posted to the Delhi survey in August 1822, travelling up to Karnāl by river. C. H. Burke and Foy were kept at Calcutta, and accompanied Hodgson to Fatehgarh in 1823. In September 1821, on Hodgson's advice, several more apprentices were recruited;

When the young men born in this country have received a complete education, they make very good surveying assistants, draughtsmen, and copyists, and if the revenue surveys are executed a door will be open for the employment of many of this class of persons. ... Still there are objections ; ... the country-born youths educated in India are sober and docile, but...of flexible dispositions, and very vain. ... The officer who conducts a survey should be very watchful over the conduct of his country-born assistants, and not detach them to any considerable distance from him, ... for alone they cannot act. ...

A number of promising lads might be selected from the Orphan Schools, and apprenticed to Government or perhaps to the Surveyor General. ... I think that if twenty boys could be selected and trained...it might be an advisable measure. ... They will not be expected to be astronomers or geographers, but merely assistants to land surveyors of estates[7].

[1] DDn. 196 (73–4), 5–7–21. [2] ib. (79), 16–8–21. [3] DDn. 147 (200), 22–3–21. [4] ib. (201), 24–3–21. [5] ib. (182–3), 19–4–21. [6] ib. (214), 1–8–21. [7] from SG. 20–7–21 ; *BRS.* (288–91).

The headmaster of the Military Orphan School [360 n.4] recommended nine boys, who are by age and qualifications calculated for the situations, ... including others who are not yet qualified, but who may probably be so in the course of a year. ... The four boys at the head of the list have a practical knowledge of surveying upon a small scale. ... I believe them to be as well behaved boys as it is possible to procure from any seminary...in this country.

They are docile, tractable, and industrious, but how they may turn out hereafter must be in the womb of time. ... If they are kept in proper subjection till they acquire experience in the ways of the world, and stability of character, which age alone can confer, I have not the least doubt but that they will turn out well. ... I have ever endeavoured to set them a good example, and if any of them...have imbibed overweening ideas of their own consequence, or an undue attachment to dress or appearance, I can most assuredly assert that it has not been fostered or encouraged by me. ...

The only boys from this school who have come under Captn. Hodgson's notice, and are alluded to by him, must, I presume, be those who were placed under Captain Morrieson, when surveying the Sunderbunds [360–1], one of whom [Clayton], and the most promising of the whole, is now no more, having recently fallen a victim to a bilious fever at Cuttack.

These boys while under Captn. Morrieson gave him the highest satisfaction [361], ... and had they not been left to their own guidance in Calcutta for a considerable period before they attained the age of 18 years (a time when youth cannot be said to have acquired stability...), it is probable that they would have continued to...afford the same satisfaction. But they were left for a considerable period without any active employment, to seek lodgings where they pleased. ... It is not, therefore, surprising...they should have picked up some of the prevailing follies, ... such as the fondness of dress. ...

I should say that their learning to dance, and mixing with the young ladies once a week ...at the public dances, are not calculated to lower the boys in their own opinion, but on the contrary to inflate them with high notions of self consequence. I know it diverts their minds a good deal from their studies, but...it was allowed with the best intentions of qualifying them to appear to better advantage in general society[1].

Six boys between the ages of 15 and 17 years, sons of commissioned or warrant officers, were bound apprentices to the Surveyor General from 2nd October 1821, "the term...to be six years, and the stipend 60 rupees per month[2]".

William Nix James.	Has a good knowledge of English grammar & parsing; of modern & ancient Geography, use of Globes, Mensuration, Trigonometry in its application to heights and distances, and is a fine tempered, industrious boy[3].
John Fitzpatrick.	Equally advanced with the above, though not quite so expert, and is a tractable, well-disposed boy.
Alexander McQueen.	Nearly equal with the above. He is a tractable boy, though he has rather a sulky look.
David Henry Chill.	An excellent penman. ... Has a good temper. ...
Edward Winston.	Not quite so perfect as the four preceding boys, ... and has not yet acquired a knowledge of the Globes. ... He is a fine, mild-tempered boy, but rather too diffident.
Edwin French	Is nearly on a par with the last, ... not so good a penman. He is a little inclined to be sullen at times.

Alexander Wyatt [366, 372] and Jenkins, under 15 years of age, were recommended for later posting.

The boys remained at the Orphan School—were put through a syllabus approved by the Surveyor General—and distributed to various surveys and offices from 1823 onwards. Four more were apprenticed towards the end of 1822, Friell, Hodges, Wilson and Jenkins. Friell was not an orphanage boy, but the native-born son of the late Lieutt. Freil of the 11th Regt. NI., and the nephew of Mr. Leycester[4] [II, 86], and of Captain Macleod of the Engineers [I, 352]. At the request of these gentlemen I have employed Mr. Freil in my office and instructed him since January last. His age is 18, and he...has received in England, from whence he only lately returned, the liberal education of a Gentleman. He is intelligent and trustworthy, and draws very well. ...

[1] from Headmaster 21-8-21; BTC. 7-9-21 (28). [2] *BRS.* (292-8), 7-9-21; period later reduced to 5 years; BTC. 28-9-21 (81). [3] James had distinguished career in GTS. and left two sons who served the dept. well; Fitzpatrick and Wyatt rose to independent ch. of rev. svy. parties. [4] Wm. Leycester (1775-1831), BCS. 1790; in ch. Sibpur Bot. Gdns. from 1821; he and Macleod m. sisters of Lieut. Friell.

Mr. Freil may be articled to me for three years from the 1st January last, as his services here have been gratuitous since that period. Also, as the cost bestowed on his education has been much greater than that of the boys at the Orphan School, and his acquirements are much superior to theirs, ... his monthly allowance may be fixed at 100 rupees instead of 60[1].

On the expiry of his apprenticeship Friell resigned, and was employed as assistant surveyor, not departmental, at Ghāzipur 1824 and Gorakhpur 1830[2].

Hodgson reports in May 1823 that

some of the young men...are now sufficiently qualified to be useful in the surveys in the Upper Provinces, and as they are now too old to be kept under due restraint at the Upper Orphan School, and their being permitted to lodge in Calcutta and left to their own discretion would be very injurious to their morals, I...send David Henry Chill, John Fitzpatrick, and Alexander McQueen...to join...Captain Oliver at Delhi and Lieutenant Bedford at Moradabad. ... The terms of apprenticeship of...six young men...have expired. ...

Graham, Polhill, and Fitzpatrick [Arthur] were brought up at the Upper Orphan School and have received probably as good an education as youths can have in Calcutta. ...

Macpherson, Saxton, and Schencks, are the sons of non-commissioned officers and privates, and were brought up in the Military Orphan Asylum at Madras. ... Schencks...is an idle young man who makes no efforts to improve himself [365]. ... Macpherson and Saxton...have only served...five years. ... Their education has been so defective that their sphere of utility is much limited; also, it being considered that being the sons of persons in low life, and brought up at a small expense, they can hardly be considered as having a claim to be paid at the same rate as the young men who have been educated at the Upper Orphan School[3]. ...

John Graham, who is the best and most useful of the apprentices, has signified his intention of accepting a situation which has been offered to him by the Judge and Magistrate of Ghazeepoor, who doubtless is not apprized of the high impropriety of this attempt on the part of Mr. Graham[4]. ... I have desired Captain Oliver to admonish Mr. Graham.

On the Surveyor General's recommendation, therefore, Government sanctioned pay of Graham to be Rs. 200 p.m.—of Polhill and Fitzpatrick, Rs. 150 p.m.—Macpherson and Saxton, Rs. 100 p.m.—the wretched Schencks remaining apprentice @ 60. It was further ruled that Surveyors should insist on their sub-assistants being provided with small tents to sleep in, and tattoos and bullocks for their conveyance and that of their necessary baggage; and if they should neglect to so provide themselves, to furnish them with what is requisite, and deduct the amount from their wages[5].

In October 1823 Arthur Fitzpatrick and Saxton resigned as they were dissatisfied with their prospects. Hodgson considered them no loss; "I shall be able to replace these persons...with others better qualified, and...more sensible of the great indulgence of Government in having provided for them in a manner beyond their merits[6]". More apprentices were engaged during 1823 and on his move to Fatehgarh Hodgson took with him, under the charge of Scott and Burke [314],

William Nix James	George Comyn	Michael Shiells
Nathaniel Hodges	Charles Hyde Burke	William Wilson
Edward Winston	Charles Christopher Foy	John Bridge
Edwin French	John James Ross	Patrick Chill
Edward Jenkins	Edward Shiells	William Chill

He had suggested that the four youngest might be left at the Orphan School, but Government considered that the senior assistants would

no doubt be fully able to carry on their instruction not less advantageously than the school master, and early discipline in the mofussil will tend to secure habits of hardihood and industry. You will accordingly take with you the boys in question, ... adopting every necessary arrangement to ensure...discipline, diligence, and good morals[7].

Two other assistants, Chick and Robert Rose, were engaged locally for the Delhi survey, where William Fraser, of the Board of Revenue [151], "had for a considerable time past employed individuals to survey parts—and villages—of the Delhi Territory, paying them from his private resources"[8].

In October 1824, four sub-assistants and apprentices accompanied the revenue surveyors from Gorakhpur and Rohilkhand on military service; Polhill with Bedford to Assam; Macpherson with Birnie Browne to Sylhet and then to Burma [72];

[1] from SG. 16-5-22; BTC. 1-8-22 (111). [2] *Ben Regr.* 192 (155). [3] from SG. 31-5-23; BTC. 12-6-23 (46). [4] Graham had tried for another post in Feb. 1821. [5] BTC. 12-6-23 (46). [6] ib. 31-10-23. [7] ib. 23-10-23 (53). [8] ib. 27-2-23 (50).

Schencks and Dumbleton with Wroughton to Arakan [333]. The remainder were transferred to Delhi or to the Revenue Surveyor General's office.

Polhill, "one of the most steady and useful of the Sub-Assistants" was employed on office duties, and, in asking for an extra Rs. 100 for him in place of a writer, Bedford reports that he "had conducted the duties of my office for the last three years. No person of proper description could be found to proceed to Assam on that salary". Unfortunately his health gave way, and in 1826 he had to be sent down to Calcutta, where he was admitted to "the insane asylum". In pressing for extra pay in Assam he had urged

the heavy losses I have sustained in being removed to the Assam Survey, and...the advanced salary (viz., Rs. 200) already enjoyed by many of my own standing in a fertile and healthy country. Wheras I am brought to Assam, where everything is extremely dear, and the climate bad. Having been obliged to leave Mrs. Polhill at Calcutta, not having partaken of her society for more than two months after our union, [and having] lost on account of her extreme grief and mourning for my departure, my child prematurely born. And in such a state I am obliged to labour under a salary that is not adequate to my expences[1].

On Blacker's death in 1826, Hodgson had with him at Fatehgarh no less than 13 apprentices, most of whom were distributed to the various revenue surveys after the Burmese War [151]. Five of them, James, Winston, William Chill, C. H. Burke, and Ross, accompanied him to Calcutta, and remained some time at the Surveyor General's Office. The brothers Shiells also went down to Calcutta, but in October accompanied Gerard to Agra [90] and were posted the following year to Rohilkhand under Birnie Browne. Hodgson asks Gerard to

keep the 2 boys strictly to their duty, and fully employed, and pay attention to their morals, habits of obedience, and cleanliness and sobriety, and insist on reading their prayers on Sunday as usual. They are not intended to be detached, nor thrust out of your sight ; they are illiterate and can only be used under strict superintendence[2]. ...

They were not educated at the Upper Orphan School ; they are European by birth, and the sons of a Serjeant in the Dragoons. In respect to the advantages of education they are very deficient, far behind the Orphan School boys ; but having been some time in my office, they are good draftsmen, and being docile and teachable, may be of use. ... Aged 19 and 17 years ; ... salary of 50 rupees per month each[3].

In December 1826 a new batch was recruited in Calcutta, and sent out to Rohilkhand, Delhi, and Sahāranpur in the following October.

Wroughton was not happy with his apprentices and, reports Hodgson,

had in person made all the measurements in the field, employing the two apprentices, Schencks and Dumbleton, in making copies only of his daily field books, in which...alone they could be of service. ... In July last I attached to his Survey two additional apprentices, Wilson and Jenkins, who had been educated at the Upper Orphan School, and who are capable of being rendered useful assistants, ... particularly W. Wilson, who is a well-disposed young man, and a tolerably good arithmetician. Edward Jenkins is an idle and conceited boy, and I have had occasion...to severely reprehend him for insolent conduct, ... and to direct Lieutenant Wroughton in case of further ill behaviour to deliver him over to the Magistrate[4].

Wroughton had described Schencks in Arakan as "industrious and deserving", but had little use for him later, and eventually Schencks, who still drew only Rs. 60 a month after nearly ten years service, submitted his resignation, expressing

an incessant...irritation of feeling and disquietude of mind, originating from the reproachful language he [Wroughton] generally used towards me. ... This morning he abused me—... and I trust the liberty I take in subscribing it may be overlooked—"Damn you, Schencks, you are not worth a curse ; you are no more use to me than my Boots" ! ! ...

I bring to your notice the length of my services, but more especially the willingness...to join the...army at Arakan, where I...suffered...the ruin of my constitution...and the total loss of my property. ... So long as I possibly could have supported the vicissitudes of Lieutt. Wroughton's unsuitable disposition, I have with the utmost resignation done. ... It would be desirable for me to beg my bread or starve...than any longer remain under his control.

Wroughton gladly released him[5].

[1] DDn. 214, 2-12-24. [2] DDn. 220 (214, 234), 11-3-27. [3] from SG. 7-5-28 ; BTC. 19-6-28 (55). [4] ib. 19-4-27 (43). [5] resd., 22-12-27 ; ib. 19-6-28 (61).

One of the successful apprentices from the Upper Orphan school was Alexander Wyatt who was engaged by Halhed, Collector of Morādābād, in 1822 [154–5];

Being the head scholar at that time, he was pitched upon, with the consent of his mother, to undertake...the articles of apprenticeship...for...5 years on a salary of 150 Rs. per mensem [372]. ... As no Assistant Surveyor could be had, and the sum of 250 Rs. per month had been allowed, it was resolved...that the disposal of that sum should take place in the nomination of an apprentice on 150 Rs., & a draughtsman (Native) on...100 Rs. per mensem. ... The draughtsman was...found incapable of performing his duty. ... The whole...survey devolved upon Mr. Wyatt, who executed it throughout to the satisfaction of the late Collector.

After Halhed's transfer, the Surveyor General refused to admit that Wyatt belonged "in the slightest degree" to the department, which left him "blasted in his hopes of advancement or promotion". The special authority of Government was then obtained for his transfer to the general establishment of Revenue Surveyors from December 1827, with the rank of Sub-Assistant[1] [363 n.3]. He subsequently rose to charge of a revenue survey party, till his death in 1857.

On Graham's transfer from Delhi to become Head Draughtsman [313], W. N. James was promoted Senior Assistant on Rs. 250. He had served continually with Hodgson at headquarters;

I have employed him near me, and instructed him with much care, and his improvement has rewarded my pains. His length of service is 6 years and 10 months; his conduct is very respectable, and he is a married man[2].

Increases of pay were made at the same time to the more useful sub-assistants—

John Gould, a good draftsman; salary to be increased from Rs. 150 to 180—J. A. Macpherson, education defective, but a tolerably good draftsman; increase from Rs. 150 to 180—J. Dumbleton, writer and draftsman...to Rs. 100—E. & M. Shiells, J. J. Ross, ... were engaged by me as apprentice writers and draftsman on...35 rupees per mensem. The two former were with me until 5th October 1826, when they were transferred to Captain Gerard on...50 rupees, and subsequently to Lieutt. B. Browne. ... Their conduct has been very respectable; recommend advance...from Rs. 50 to 80. The latter is still employed in the office. ...

The accompanying list will shew a decrease in number among uncovenanted servants by death—and by several of them having left the service—and a further decrease may be naturally anticipated. ... I...recommend that a few additional...boys should be...apprenticed on the usual terms, vizt., at 60 rupees per mensem for six years. ...

It is from the class of well-educated young men born in the country, the orphans of Officers, that we must expect our best recruits for the Survey Department, and when acting... under the immediate superintendence of European officers they perform useful...duties[3].

William Brown [157–8] could hardly give his assistants

too much praise. The conduct of Mr. D. H. Chill, the senior, ... has been most exemplary, and in justice to them all I...mention the daily hours of work, during which they have been constantly employed, ... without a murmur. ... To get at their ground...every morning, Sundays and three holidays in the year (Christmas, New Year's Day, and the last day of the Holee[4]) excepted, they had to get up an hour before daybreak, and after remaining out till a late hour, had on the same day to protract and finish their daily work, no halts being permitted for this purpose. And thus were employed 8 or 10 hours every day, the greatest part of the time labouring on foot thro' the fields; and this last season with scarcely an exception were they ever absent from sickness or any other cause, but were most unremitting in their duty[5].

In January 1829 the field establishment numbered 7 sub-assistant surveyors, 11 apprentices, and 4 writers and draughtsmen distributed between the five district surveys [165]. There was no regular establishment maintained for other Bengal surveys, though occasional assistants were picked up on temporary engagements.

SPECIAL ENGAGEMENTS

Civilian surveyors were engaged from time to time—some useful—some failures. Nothing is known of the "young man named Jackson, a seafaring man", who was

[1] from B. Browne, 27–3–28; BTC. 6–2–29 (41). [2] ib. 21–8–28 (36). [3] ib. 21–8–28 (36).
[4] Hindu Festival. [5] BTC. 18–9–28 (33).

engaged in 1819 by the Collector of Bakarganj to survey the rich islands of the creeks and rivers; the Surveyor General was "miserably disappointed" with his work [140].

Morgan Blandford came out to Calcutta in 1810 and from 1817 to 1819 was assistant to Gerard in Sahāranpur on Rs. 200 p.m. [23]. He was an excellent draughtsman and a delightful specimen of his work appears on plate 3. After several years as indigo planter in Tirhut he returned to business in Calcutta. His ability as surveyor was not forgotten and early in 1835 he was employed on a special revenue survey near Barasat in the 24-Parganas[1]. He broke down with fever and died at Calcutta later in the year.

Alexander Laidlaw came to India with a recommendation from the Directors as "Mineralogist and Investigator of Natural History", though lacking a "liberal education" [268]. Even though he drew salary Rs. 600 p.m. plus Rs. 200 for hill carriage, and free issue of instruments and stores, to say nothing of an advance of Rs. 2,500 in cash, he produced nothing whatever from more than two years sojourn in the Kumaun Hills [266–8]. The Directors ordered his dismissal, and withdrew his permit to reside in India, but he stayed on quietly in Almora District, and died in the village of Pithoragarh on 6th August 1836.

Robert Tate had been employed under the Marine Surveyor General, and Mackenzie obtained his appointment to the Kumaun survey in September 1818 on the same salary as Blandford. He thought his experience would be "useful in the survey and climate of an unequal mountainous country"[2], and that Webb would find him useful as a draughtsman [48, 274][3];

> Mr. Tate...does not draw finely, but I think he understands the subject so well that he will materially assist in correct delineations, which I consider much more important than fine drawing. Were it possible indeed to get a very superior draftsman, I doubt whether any could be induced to go up, as they are so much wanted here. The Mr. Nicholls you mention is either dead, or has long since left this[4].

Tate joined by the end of the year, and, in submitting his first map [pl. 6] Webb reported that he had "every reason to feel satisfied and pleased[5]" with his ability and industry. Mackenzie agreed that it was "a very handsome & a very satisfactory map", and "exceeded all he produced here". Unfortunately this good impression did not last; and about a year later Webb wrote privately that

> Mr. Tate is very well qualified to do all I require as a draftsman, and his natural talents are good, ... but his actual knowledge is very limited in practice and as to theory he has no opportunities of study. Unfortunately, however, his disposition has too much vanity and self-conceit mixed up with it, and too little humility, to render him a teachable subject, and I have long given up all thoughts of playing the part of tutor to such a forward genius.
>
> His violence of temper and cruelty towards the natives makes him so annoying a neighbour that I shall always contrive to keep him at a distance from my camp, but many of these objections would vanish if he were confined entirely to the duties of draughtsman. ...
>
> Mr. Tate, if employed as an Assistant, must bye and bye get some travelling allowance, and the sum so given to him would amply remunerate two or three natives who, working upon fixed points of mine, would get through a great deal more work than Mr. Tate can do, and between us we should find sufficient employment as a draftsman. ... Such an arrangement would hasten the completion of the survey; create no expence, and remove 1,000 difficulties, and, last but not least, add greatly to my comfort[6].

Webb was not given further help, and Tate had to be used on field survey, for which he drew hill surveyor's allowance of Rs. 200 [346–7].

When the survey was wound up at the end of 1821 Tate's application for charge of some other survey was not recommended;

> Mr. Tate states...that Colonel Mackenzie had held out to him the prospect of a succession to a survey as the ultimate result of his services. ... It is not likely that Colonel Mackenzie would make any such assurance to a person of Mr. Tate's description, for...I apprehend that Government will continue to place at the head of their surveys their own military officers, who are, on a variety of considerations, the only persons fitly qualified for such duties. ...

[1] BRC. 22-1-35 (26). [2] ib. (281), 13-8-18. [3] DDn. 133 (288-90), 12-5-18. [4] Nicholls pensioned from 28-4-15 [II, 273]; England, 1864; DDn. 156 (144), 30-11-18. [5] ib. (95), 4-3-19. [6] DDn. 150 (131).

Mr. Tate is wrong in supposing himself attached to the Surveying Department. ... His temporary services were hired on the 11th September 1818, and...ceased with the close of the Kumaun survey on the 31st December last, ... and I think them fully remunerated by the salary of 200 rupees per month and 200 for extra allowance for hill carriage. ...

The journals and field books which he made when detached from Captain Webb...afford no favorable testimony. ... They are most defective in information, and the execution is very slovenly indeed. The map of Kumaon Mr. Tate states to be his performance. ... Captain Webb constructed the map, and Mr. Tate, as draughtsman, did his duty in fair copying it. The execution, though not excellent, is sufficiently good. On the whole...neither the talents, services, nor character, of Mr. Tate give to his expectations...the least support[1].

Good draughtsmen were always difficult to get, and Baker found no one in Calcutta to fair copy his maps of Java [II, 138];

On the 1st December last I hired a draftsman recommended by Colonel Fleming [II, 340], who by the 25th January had...succeeded in spoiling two maps, so miserably done that they were far inferior to the original rough copies. ... I had the honour of shewing...the work...to His Excellency the Earl of Moira who...was much dissatisfied with the draftsman Da Cruz's work, of which I informed the man. ... Instead of taking this in good part, he next day sent me a note declining to work any longer, leaving his two maps unfinished.

I then advertised for a draftsman, and a lad named McPherson came, who stated that he was an apprentice in the Surveyor General's Office [II, 273 ; III, 312], but had full leisure enough to undertake copying the only map then wanting, which I shewed him. ... From the 1st February to the present day he had not attended more than two out of three days, and now sends notice that in consequence of arrangements in the Surveyor General's office, he can attend no longer, leaving the only job he had to perform not quite half finished.

Mr. Da Cruz has unfortunately received one month of the handsome allowance Government was so good as to grant me, and is very anxious to receive the other month. Mr. Macpherson will no doubt be equally solicitious for his month and a half. ... I conceive the conduct of both to be an imposition...and...I may be instructed not to draw anything further for either of these men. ... In the meantime I shall get on as I can with the map thus left on my hands[2].

Little is known about the various extra-departmental surveyors employed from time to time on the revenue survey of the 24-Parganas and the Sundarbans [139]. During 1817 the Collector had three "experienced surveyors" Blechynden, Mackay [II, 419], and Gardner[3], working for him. On the Board of Revenue's report that the work of *amīns* was unsatisfactory [141], Government agreed to the temporary employment "of a limited number of [European] surveyors by the Collector...in lieu of a part of the establishment of native surveyors"[4].

One of these European surveyors was Henry Osborne [12], engaged by the Collector of the 24-Parganas in 1817[5], and assisted for a time by a son[6]. In February 1822 the Collector asked for an extension of the engagement;

I believe...an European surveyor who thoroughly understands his business, as Mr. Osborne does, & who discharges the duties...in an upright manner as Mr. Osborne has done, a very great benefit to the Public, as well as to Government. He is a check to the native surveyors, who are always open to bribery, besides improving them in the theory of their profession.

The Board have had frequent opportunities of observing the services of Mr. Osborne by various plans & reports...which could never have been obtained from the native aumeens. ... I am extremely sorry to say that young Mr. Osborne has been obliged to quite India. Mr. Osborne, senior, is still in charge of his office as Surveyor to the 24-Pergunnahs[7].

Henry Osborne resigned the following year, and the Collector obtained the appointment of a younger son William,

about seventeen years of age, whom he has also been bringing up to the profession of a Surveyor. ... He is not yet sufficiently master of his profession to undertake any large surveys, &...not ...competent to the duties with which it was proposed to entrust his brother; at the same time he thinks him capable of making all the measurements (under his superintendence), furnishing any plans...required. ... One of the principal objects in wishing to have an European Surveyor

[1] from SG. DDn. 198 (62–5), 20–4–22. [2] DDn. 141 (287–9), 21–3–17. [3] B Rev Bd. 18–3–17 (10); Mackay d. 25–6–17; Thos. Alan Hyde Gardner, Asst. in Surveyor's office 24-Parganas, *Cal An. Rev.* 1818; relative of Col. W. L. Gardner [32 n.2]; indigo planter, Nadia, 1818. [4] B to CD., Rev., 4–7–17. [5] *Ben. AR.* (182) (xviii); Henry Osborn was purser on ship *Mangles* 1815/6. [6] map copied in SGO. 1819 by G. Osborne; pr. the Geo. Osborne, survr. to Opium Dept., Ghāzipur, 1836. [7] B Rev Bd. 5–3–22 (49).

...is that I may have some person in whose integrity I can rely in all cases of disputed measurements. ... I...recommend...him as Surveyor...on a salary of 100 Rs. per month[1].

Three years later the younger Osborne broke off survey of Chinsurah owing to a dispute about his salary, much to the regret of the Collector who greatly appreciated the reliability of his work[2]. The Surveyor General was asked to settle a fair rate, and as he thought "the terms which Mr. Osborne is willing to undertake to finish the survey of Chinsurah very moderate", Government agreed to pay Rs. 500 for "a neat map, finished with the same detail as the portion already executed"[3].

For the revenue survey of 1821 [141], the Commissioner of the Sundarbans obtained the Surveyor General's approval to engage

the nephew of the late Mr. Jones, well known as a Civil Engineer, on...120 rupees per month, and his travelling expenses paid by Government, and also a young country-born man to serve as waiter, or apprentice, on...50 rupees per month, and his expenses paid[4] [139].

Jones broke down after a year and Government informed the Directors that

Mr. Jones, an uncovenanted assistant attached to the Sunderbuns survey establishment, ... labouring under mental derangement, we...provide him with a passage to England. ...

We have—under the alleged difficulty of procuring...an able assistant for a service involving much discomfort and exposure, and on the assurance...that the employment of Dr. Duncan, the medical gentleman attached to the Commission[5], as Assistant Surveyor will not hinder... his medical duties—authorized the employment of that gentleman as assistant to Ensign Prinsep on...250 rupees per mensem to cover all charges. We have likewise...authorized an increase of 50 rupees per mensem to...the apprentice attached to Ensign Prinsep[6].

To assist Fisher in Sylhet, the Surveyor General recommended James Blechynden who had worked for the Collector of the 24-Parganas[7] [136], and on various other drawing and survey jobs since 1815.

Mr. Blechynden, who was...educated for that branch in England, ... whose father was a well known surveyor in Calcutta, bears a respectable character. He subsists by the exercise of his talents as a Civil Engineer and Architect. He agrees to go to Sylhet as an assistant to Lieutenant Fisher...at 250 rupees per month, and 100 extra as travelling charges. These terms appear to be high, but I do not think I can engage them for less, as he had a family to support, and an opinion prevails here that the climate of Sylhet is insalubrious. ...

The Board, considering that the field operations in Sylhet can only be carried on during 5 months in the year, is of opinion that the services of the surveyors might be engaged for that time only, and that they might be employed elsewhere during the rest of the year. ... The indoor work to be done when a...party leaves the field is very heavy, in computing and making maps and reports, ... generally...one third of the time employed in the field operations[8].

Blechynden's appointment was sanctioned, and he reached Sylhet on 15th December 1823, but entirely without instruments, and Fisher reported that,

all my instruments being private property, ... collected...at considerable expense, I am unwilling to part with any of them ; nevertheless, had I any to spare, I should not hesitate to give them up. ... Mr. Blechynden may be advantageously employed with me in learning the nature of this survey, ... and by the time he shall have acquired the requisite knowledge, ... he will, I hope, have received from you a supply of the instruments, ... etc [9]

Fisher was, however, called away for military duty almost at once [145], and Blechynden was carried off by Scott for important work in the Assam Valley [51], where he held charge of revenue surveys till about 1827 [146].

Hodgson had no great opinion of professional surveyors of this type

hired in Calcutta. I have experience to warrant me in the case of Mr. Blechynden and others, and know that their object is to get a salary and do as little as possible ; still, as there are not many persons who would be willing to be employed in the Sunderbunds, I think Mr. [Wm. ?] Osborn's services should be engaged as proposed by Lieutt. Hodges, during good behaviour.

Apprentices from the Orphan school cannot be engaged without the express orders of Government, nor can they be tutored in so short a time as Mr. Hodges supposes. ... Young men of that class...would turn to more profit in the regular revenue surveys in the North West Provinces. ... His operations would be more likely to be retarded than facilitated by

[1] B Rev. Bd. 16–9–23 (12). [2] from Collr. 30–12–26 ; B Rev Bd. 12–1–27 (38 A). [3] ib. 30–1–27 (62) & 20–7–27 (27). [4] BTC. 7–12–21 (10). [5] James Duncan, Asst. Surg. 1821 ; ret. 1842 ; d. 1853. [6] B to CD., Rev., 30–7–23 (80–3). [7] not Richard as wrongly stated p. 136 n.3. [8] BTC. 9–10–23 (23). [9] DDn. 212 (529–30) 20–12–23.

the charge of inexperienced boys, whose wages and travelling expences would be heavy compared with the value of their services. ... Fully as much effective services in the field might be rendered by 2 or 3 stout native mootsuddies...who can read and write their own language. They could attend the surveyor, and write down notes and remarks, and assist in directing the chain and wheel men, and might be made very generally useful [388–90][1].

Three useful assistants were found for the Upper Provinces, Nelson, Macan and Terranneau. Nelson had been in the Royal Navy, but found employment in India from 1818. The Surveyor General engaged him in 1821 to assist Bedford in Rohilkhand [154]. Being called to military service in 1824, he was given command of the *Dragon* schooner in Arakan for survey of rivers and creeks. After the war he returned to revenue surveys, in the Upper Provinces till his death at Dehra Dūn in 1839 [165]. Macan had

highly respectable connexions, and was intended for the Army, but circumstances have hitherto prevented his obtaining a cadetship or commission. ... If His Lordship in Council should be pleased to appoint him on the same terms as Mr. Horatio Nelson, with a salary of 250 sa. Rs. per month and the boat allowance of a subaltern officer, to Goruckpoor, I would recommend that he should join Lieutenant Wroughton without loss of time[2].

During the war, Macan was sent to Burma with Birnie Browne [72], and rejoined Wroughton on January 1st 1827.

Being quite inexperienced in topographical measurement, was upon his arrival quite unequal to afford me any assistance, and...the two young additional apprentices[3] had never...been employed upon any duty of any kind. ... Although the number of my assistants were increased two-fold, they did not bring with them the ability or fitness...I had calculated upon, and... some considerable time elapsed ere they were made in any way competent[4] [152].

Macan soon picked up the work and remained with the Gorakhpur survey till his death at Allahābād in October 1830.

Robert Terranneau was son of an indigo planter, and in 1827 was employed on revenue duties under the Collector of Morādābād, on whose recommendation he was appointed assistant in the revenue survey [434].

A valuable addition to the Surveyor General's staff of draughtsmen was obtained on the winding up of the Nāgpur survey in 1831. John Cornelius had been employed in the Quartermaster General's office at Madras from 1820 to 1822, and then served with Norris who left a "chit" that he had worked

in the survey department at Nagpore, from 1824 till its abolition in June 1830, as Sub-Assistant and Draughtsman, and...displayed the utmost zeal, activity, and assiduity, both in the field and in office. As a plane-table surveyor his exertions were invaluable, and to his services as draughtsman, and his unremitting attention, ... I am chiefly indebted for the compilation...of the map of the Nagpore survey, which has lately been presented by me to Government [93 ; pl. 10 n.]. ... The private character and conduct of Mr. Cornelius are above all praise[5].

Cornelius was appointed to the Surveyor General's office from 1st October 1831, and though an excellent draughtsman was drawing only Rs. 80 p.m. in 1845[6].

NOMINAL ROLL

Name	Birth & Death	Apprenticed	Employment	Domestic
BELL, Chas.	b. 1810–11	1826	ed. Kidderpore [360 n.4]; Delhi, Oct. 1827.	unm. 1848.
BRIDGE, John	b. 1808–9	1823	ed. Kidderpore; with RSG. to Fatehgarh, Nov. 1823; Delhi, 1826.	m. before 1848.
BURKE, Chas. Hyde	b. c Aug. 1802	1821 (to SG 1816)	SGO. 1820; Orissa, Jan. 1821; SGO. 1822; Fatehgarh, 1823–6; SGO. 1826–7; Sahāranpur, Oct. 1827; Bulandshahr, 1829.	Son of L. R. Burke, Registrar [II, 352].

[1] from SG. 27–10–28; BTC. 30–10–28. [2] ib. 9–7–24 (57). [3] Wilson & Jenkins [152 n.5, 365].
[4] from Wroughton, 12–12–27; BTC. 19–6–28 (61). [5] DDn. 265 (204), 23–3–31. [6] DDn. 464 (9), 1–5–45.

Name	Birth & death	Apprenticed	Employment	Domestic
BURKE, Marcellus [II 351]	d., Vepery, 23-10-65, aged 75	1805	from Madras [384] arrd. Calcutta, March 1818; Cuttack, 1818; leave, 1819; Orissa, 1821; SGO. 1822; Fatehgarh, 1823; SGO. 1826; with DSG., NWP., 1832; resd. 1838.	Son of Francis & Margaret Burke and bro. to Lucius Rawdon; m., Calcutta, 22-11-20, Eleanor Rosalie Meneaud sister of Aug. [386]; she d. Vepery, 4-5-66.
CHICK, Wm. E.	...	...	Under Bd. of Rev., Delhi; Sub-Asst. Survr. Delhi, Feb. 1828-28.	
CHILL, David Henry	b. 4-4-05	1821	ed. Kidderpore; Delhi, June, 1823; Sahāranpur, 1827; Bulandshahr, 1829; dsm. June 1833. Dmn. SGO. Calcutta 1832-5.	One of 8 sons of Depy. Commy. Sam. Geo. Chill (1759-1845); Ben. Art. 1785.
CHILL, Geo. Constable	d. 24-6-70 aged c. 55	1823	Fatehgarh, 1823; SGO. July 1826; Gorakhpur, June 1828; later Customs Dept. and land owner.	Son of Sam. Chill & Ann Apsley his wife (She d. Calcutta 1834).
CHILL, Pat. Spenser	bapt. 31-1-08	1823	Fatehgarh, 1823; Sahāranpur, 1826; Bulandshahr, 1829.	4th son of Sam. Chill.
CHILL, Wm. Richard	b. 3-6-09	1823	Fatehgarh, 1823; SGO. 1826; Gorakhpur, June 1829. Rev. Svys. NWP., Sind, & Bihār till 1851.	5th son of Sam. Chill. ;m. 15-8-32, Indiana Clarke, of Muzaffarpur.
CLAYTON, Horatio	b. c. Sept. 1801; d. Cuttack, 1821	1817	ed. Kidderpore; Sundarbans, 1817; SGO. 1818; Cuttack 1819.	Son of Lt.-Col. Thos. Wm. Clayton, Ben. Inf. (d. 1804 aged 50).
COMYN, Geo.	b. 6-9-08	1823	ed. England; Fatehgarh 1823; Delhi, 1826; NWP. 1831-4; dsm. 1834; re-emp. Patna 1841; ret. 1846.	Son of Lt.-Col. P.T. Comyn. of 24th BNI.
DAVIS, Wm.	...	1826	ed. Kidderpore; Sahāranpur, Oct. 1827; Bulandshahr, 1829.	
DUMBLETON, John	d. Allbd. 19-9-54 aged 50 y.	1818 Dmn.& Writer	ed. Calcutta; Orissa Jan. 1821; Gorakhpur, Oct. 1821; Arakan, 1824; Gorakhpur 1827-30; NWP. to 1837.	Son of Sgt. Dumbleton, overseer in Lower Orphan School.
FITZPATRICK, Arthur	b. 1-10-02	1817	ed. Kidderpore; Sundarbans, 1817; SGO. 1818; Gorakhpur, March, 1823; resd. Oct. 1823; SGO. 1824.	Son of Depy. Commy. Robt. Fitzpatrick.
FITZPATRICK, John	Jan. 1806	1821	ed. Kidderpore; Morādābād, June 1823; in ch. Rev. Svy., Balasore, 1838; Purnea, 1840-5.	bro. of Arthur.
FOY, Chas. Christopher	b. Delhi, 25-12-09	1821	Orissa, Jan. 1821; SGO. 1822; Fatehgarh, Nov. 1823; Delhi, July 1826; Bulandshahr, 1828 Sahāranpur, 1827; Punjab cis-Sutlej, 1853.	Son of Condr. Andrew Foy of Delhi Mag; m. 23-8-30, Meerut, Sarah Few; m. 2nd, 15-10-35, Meerut, Cecilia Templeton, 15 y.
FRASER, Simon	d. Sahāranpur, 28-5-22	1816	ed. Kidderpore; Upper *Doāb*, May 1816; Sirmūr, Feb. 1820; Delhi, 1822.	pr. son of Simon Fraser (1780-1845), Ben. Inf.
FRIELL, Philip	b. 1804	1822	ed. England; SGO. 1822; resd. 1823.	nat. son of Lieut. Simon Philip Friell (1780-1804) Ben. Inf. [363-4].
FRENCH, Edwin	b. April 1806	1821	ed. Kidderpore; Fatehgarh, Nov. 1803; Delhi, July 1826; Sahāranpur, 1827; dsm. 1828.	Son of Capt Robt. French (1777-1811), Ben. Inf.
GORE, Wm. Francis	d. July 1846	1826	ed. Kidderpore; Gorakhpur, June 1829; Rev. Svy. NWP. & Bihār till death.	Son of Dep. Commy. Gore.
GOULD, John	b. c. March 1800	1813	ed. Mil. Asylum, Madras; SGO. Madras; to Bengal, July 1817; Orissa, Jan. 1821; SGO., 1822; Delhi, 1822-33; Rev. Svys. NWP. till 1841.	Son of Sgt. of HM. 59th Foot, kd. at Cornelis, Java, 1812; m., Delhi, 21-12-24, Charlotte Staines.
GRAHAM, John	b. 7-12-1801; d. Calcutta, 19-7-58	1816	ed. Kidderpore; Upper *Doāb*, May 1816; Sirmūr, Jan. 1820; Delhi, Rev. Svy. 1822; Sahāranpur, 1826; SGO. 1827; Hd. Dmn. Aug. 1828 till ret. Feb. 1858.	Son of Capt. John Graham (pr. Ben. Inf., d. Amboina 1802); m., Meerut, 6-1-20, Mrs. Arabella Smith; re-m. thrice in Calcutta.
HODGES, Nathaniel	b. March 1805	1823	ed. Kidderpore; Fatehgarh, Nov. 1823; Delhi, July 1826-35; NWP. 1836-42.	Son of Capt. A. Hodges.
JAMES, Wm. Nix	b. Dec. 1804 d. Chunār 14-6-44	1821	ed. Kidderpore; Fatehgarh, Nov. 1823; SGO. July 1826; GTS. 1831; 1st Princl. Sub-Asst Aug. 1841.	Son of Richd. James (1787-1813), Ben. Inf.; m., Calcutta, 12-10-27, Mary Anne White.

NOMINAL ROLL—(*Continued.*)

Name	Birth & Death	Apprenticed	Employment	Domestic
JENKINS, W. Edward	b. 29-1-07	1822	ed. Kidderpore; Fatehgarh, Nov. 1823; Delhi, July 1826; NWP. till death at Moradābād, Sept. 1837	Son of Wm Jenkins;
LOCKWOOD, Thos.	...	1814	Dmn., SGO. from 1814 till omitted in list of Dec. 1824; with Ferguson in Surgujah, 1822.	
LUCKSTEDT, Peter	...	1826	ed. Kidderpore; Rohilkhand, Oct. 1827 disch. 1835.	pr. son of John L., Asst. Commy., d. 1836 aged 61.
MACPHERSON, Andrew	b. 31-8-02	1818	ed. Mil. Asylum, Madras; to Bengal, 1818; Orissa, Jan. 1821; Morādābād, Nov. 1821; Mil. service, Sylhet, Oct. 1824; Burma, 1825-6.	
MACPHERSON, J. Andrew	...	1813 as dmn.	SGO. 1813; [II, 273]; Sub-Asst. Delhi Rev. Svy. 1823; pension, 1830.	Son of Capt. John Macpherson, country-born officer of Marātha service.
MCQUEEN, Alex.	b. 12-1-05	1821	ed. Kidderpore; Morādābād, June 1823; Delhi, 1824; Morādābād, Sept. 1827; disch. 1833.	Son of Sgt. Maj. Alex. McQueen.
MUNRO, David	...	1826	ed. Kidderpore; Sahāranpur, Oct. 1827; Delhi, 1829.	
MUSTIE, John	b. c. Dec. 1798	1813	ed. Mil. Asylum, Madras; SGO. Madras 1813; to Bengal July 1817; Orissa, Jan. 1821; Delhi, 1822.	Son of Sergt. Mustie.
POLHILL, Wm.	b. c. July 1801	1817	ed. Kidderpore; Sundarbans, 1817; SGO. 1818; Cuttack, 1819; Morādābād, Nov. 1821; with Gerard to Sironj, 1822-3; mil. service, Assam, Oct. 1824; sick to Calcutta, May 1826; Insane Asylum, 1827.	Son of Lt.-Col. Thos. Polhill (1746/7-1804) Ben. Inf.; m. c. 1824, Calcutta.
ROSE, Robert John	...	1823	under Bd. of Rev. Delhi, 1822; Sub-Asst., Delhi Svy., 1823-7; PWD. Orissa; road svys., eg. MRIO. 42 (4-6), 47 (6); Supt. roads & conservancy, Calcutta, c. 1840-55.	Ruling Elder, Free Ch., Calcutta, 1855; nat. hist. specimens to ASB.; *v. JASB.* IX (91); XVII (559).
ROSS(E), John Jas.	...	1823 as Dmn.	Fatehgarh, Nov. 1823; SGO. July 1826; Rohilkhand, 1829.	Son of Qmr. Ross, HM. 8th Lt. Dragoons.
SANDERSON, Thos.	d. Sahāranpur, 7-9-34	1826	ed. Kidderpore; Sahāranpur, Oct. 1827; Bulandshahr, 1829.	
SAXTON, Benjamin	b. 31-8-03	1818	ed. Mil. Asylum, Madras; to Bengal, 1818; Orissa, Jan. 1821; Morādābād, Nov. 1821; resd. Oct. 1823.	Son of Sgt. Maj. Saxton.
SCHENCKS, John Henry	b. 15-9-01	1818	ed. Mil. Asylum, Madras; Bengal 1818; Orissa, 1821; Gorakhpur, 1822; mil. service, Arakan, 1824-5; Gorakhpur, 1826; resd. 1827; re-empld. NWP. 1834-7; disch. 1837.	Son of Sgt. on Mad. Est.
SHIELLS, Edward	d. 20-4-37 aged 29 y.	1823	with RSG. to Fatehgarh, Nov. 1823; SGO., July, 1826; Morādābād, 1827; with Gerard to Agra, Oct. 1826.	Sons of Sgt. Maj. S.; Edw's dau. d. Calcutta, 1832, aged 4 y.
SHIELLS, Michael	b. 1811 d. 20-4-36	1823	as above	Michael's inf. son d. Meerut, 1-10-33.
WILSON, Wm. A.	...	1822	ed. Kidderpore; Fatehgarh, 1823; Gorakhpur, 1826; dmn., SGO. 1830-3; Rev. Svys. till 1848, with ch. 1844-7.	m., Calcutta, 1833; m. 2nd Calcutta 31-8-42, Mrs. Margaret Mitchell.
WINSTON, Edw.	b. Aug. 1806	1821	ed. Kidderpore; Fatehgarh, Nov. 1823; SGO. July 1826; with DSG. till 1842.	Son of Lieut. John W. (1785-1808) Ben Inf.. m. Allahābād, 2-11-37, Miss Mary Lawler.
WYATT, Alex.	b. Jan. 1807 d. 1857	1822 to Collr. [366]	ed. Kidderpore; Morādābād, 1823; NWP. Rev. Svy. to 1842; ch. Ben. Rev. Svy. parties 1844-57.	Son of Surg. Geo. Nevill W. Ben. Med., who d. 1817. Alex. m. Sophia.
WYATT, Geo. Nevill	b. 31-10-17 kd. 1857.	1826	ed. Kidderpore; Rohilkhand, Oct. 1827; Morādābād, 1829 - NWP. Rev. Svy. till 1841; Dep. Collr. Benares, 1841-55; then Indigo planter.	bro. to Alexander m. Augusta Warren.

CHAPTER XXVI

CIVIL ASSISTANTS, MADRAS & BOMBAY

Madras — Great Trigonometrical Survey — Bombay — Nominal Rolls.

ON the appointment of a Surveyor General of Madras in 1810, it was decided to transfer the assistant revenue surveyors, except those wanted by the Tank Department, to the control of the Surveyor General [II, 348]. After the district surveys had been finished off, those assistants who were not wanted by the Surveyor General, or on Lambton's survey, were to be found other employment or sent on pension. The observatory school was closed, and the Surveyor General made responsible for the recruiting and training of any new apprentices.

On Mackenzie's return from Java and Bengal in 1815 he found 29 of these assistant surveyors on his establishment;

Drawing Office at Madras:
William Scott
Charles Baillie
Sylvester Pope
William Lantwar
Henry Hamilton
James Summers
Thomas Hill
William Howell
Thomas Anderson
Charles Barnett

Military Institution
Marcellus Burke

Lambton's Trigonometrical Survey:
Peter Lawrence
Joshua De Penning
Joseph Olliver
William Rossenrode

Ceded Districts
Michael Dunigan

Sonda
John Faulkner
John Terry
Richard Long
John Malcolm
Frederick Richard Ficker

Tinnevelly
John Robinson

Dindigul
Thomas Turnbull
James Aikin
William Keyes
Christian Pereira
William Bird
Andrew Chamarett
Charles McMahon

By June 1817 these had been distributed between the office and various field surveys;

S.G.O. Madras—Pope, on reduced pay, sick; Baillie, Dunigan, Chamarett [II, 350–1], Bird on sick certificate.

With Ward, Travancore—Turnbull, Aikin, Pereira, Keyes, McMahon.

With Conner in Coorg—Faulkner, Long, Ficker.

With Garling, Nizām's Territories—Howell, Hill, Malcolm.

With Scott, in Northern Circārs—Hamilton, Summers, Terry, Burke, Barnett, Anderson.

Lambton's Survey—Lawrence, De Penning, Olliver, Rossenrode.

In addition to the above Gould and Mustie, apprenticed in December 1813 to Mackenzie personally, accompanied him to Bengal in 1817 [II, 345; III, 316]. Robinson went to the Tank Department. Lantwar died in May 1817, having since 1811...executed with uncommon assiduity and industry the complicated duty of Examiner, Register, Reviser of accounts, calculations, &c., in this office, as well as the professional duties of drawing and reduction of maps. After a series of ill health, impaired by close application, was taken ill immediately after the preparation commenced for the transfer of the Depot [II, 346, 352; III, 315][1].

On his move to Bengal, and at the suggestion of the Bengal Government [359] Mackenzie arranged for three of his most capable surveyors, Scott, Hamilton, and Burke, to be transferred with him [360][2]. He had intended them to move by sea

[1] from SG. 1-& 7-6-17; MPC. 447/1817, 24-6-17 & MMC. 636/1817, 5-8-17. [2] with rise of pay.

from Masulipatam, but as they could not get away before the turn of the monsoon [I, 303], Hamilton and Burke, after waiting from 16th September to 1st January, made the tedious march up the east coast through Ganjam. Scott continued in charge of the survey at Masulipatam till he got a sea passage in March.

To further strengthen the staff in Bengal, Howell was sent up in July 1819, but after reaching Calcutta with wife and family, refused to join the Cuttack survey, and submitted his resignation, much to Mackenzie's disgust;

> Howell has behaved ill; he has refused to go to Cuttack, and has actually sent in a letter saying he has resigned the service. Will you look for, and send me a copy of, the Bond that was formerly taken from these youths [II, 349]. This is a bad specimen of our Madras native establishment, ... which annoys me after I had spoken favorably of them, and will also occasion restrictive orders, if not suppression, of any further establishment of this kind. Two instances of refusal to do their duty[1].

The other refusal had been that of Thomas Anderson who had pleaded ill health to avoid the move. Howell's own explanation was that he had agreed to the transfer "on the promise of an increase of salary" which was not kept.

There was a steady drain through sickness and death. Pope was pensioned and died at Madras in 1818; Pereira died the same year in Travancore; Terry died at Hyderābād in 1819, and Bird and Baillie the year after. The life was a hard one. Terry had been constantly sick in Sonda [II, 158–9], but Ward

> never thought much of him; he appeared to have too much of the beau about him, though it appears Mr. Garling had an high opinion of the man. Scott must look to him or he will try to have the ascendency[2].

Bird, whose work in Tinnevelly has already been noticed [II, 145], was constantly sick in Travancore. Ward, who "had a good opinion of him at the beginning", found him, "tho' clever, unwilling and too full of natural duplicity". The doctor who attended him was treated with "disrespect and insolence", attributing this to "intoxication", so Ward was "very happy he was removed. ... He has done little or nothing since the commencement of the survey". Bird was given leave to Madras, but overstayed it by several months, which Mackenzie thought typical of his "light horseman" attitude to life. Though he won a good report from Sim by work at Pondicherry Mackenzie advised Mountford

> not to send him to Hyderabad till some officer is appointed [Garling had just died]. He can lose no time by employment in the office, and you will have an opportunity of getting acquainted with his talents and disposition, which I am afraid Pondicherry has not much improved; but Hyderabad will be still worse to one of a volatile disposition. ... Bird was a young man whom I wished to have some previous instruction in the office. ... The Assistants... should get an opportunity of making themselves known to the office in charge.
>
> There were also circumstances in Bird's case which make it desirable before he is launched forth into a country where, upon my word, I consider it peculiarly necessary they should not be left to their own discretion. Who is there to look to them, or how are they to be employed till some officer is appointed[3]?

Bird was sent up to Ellore under Hodges, and died there of cholera three months after Mackenzie's letter.

Ward was keen to maintain the standard of work in Travancore;

> I have lately detected some gross errors in the tract executed by Turnbull & Pereira, which I conceive is owing to laziness & neglect. They have laid down places they have never seen, or been at merely with an inattention, to save themselves a little trouble, & have filled large spaces with wood, which contains much detail. ... I...point out to them their errors in two or three instances, with a hope they will be more particular in future[4].

Bad work is often due to ill health, and Pereira died eighteen months later, whilst Ward found that Turnbull, though "a very useful and intelligent man", was "now far advanced in life [only 36 years!] & whose eyesight...is very bad". At the close of the survey he was sent to collect statistics in Tinnevelly [II, 146; III, 167, 320].

Summers, whom Mackenzie regarded as "an expert, clever, surveyor", had to resign in 1819 owing to asthma or consumption. Pensions had been sanctioned

[1] DDn. 149 (95), 21–11–19. [2] DDn. 156 (189), 28–11–16. [3] DDn. 149 (141), 21–9–20. [4] DDn. 156 (199), 5–2–17.

for Peter Lawrence, and some widows[1], but it took three years to get one sanctioned for Summers, and Mackenzie asks Mountford to be

> kind to him. The real laborers ought to be well paid. ... As long as he was able to do his duty in the field, he did it. ... His claims are stated and admitted. His services after he went to Ellore and Masulipatam are known to yourself. ...
>
> As to his conduct and state of health, reference will be made to yourself; if he is, as I verily believe he is, unfit for active field, or even close, service, something should be allowed him, adapted to his term of service, to his labor, and to his character. As far as I know, he was never accused of drunkenness, sottishness, or suspicion of theft, like the only precedents of the 10 pagodas. The civil auditor in fact is not a judge of their pretensions[2].

Summers was allowed a pension of Rs. 61-4 p.m., and was given light work in the drawing office till after 1830 [401]. He left two or three sons in the survey.

About this time the Bombay Government asked for the services of as many assistants as possible, but only one, James Aikin, could be spared [125]. He gives Jopp the following account of his services ;

> In 1816 I was placed...under the orders of Captain B. S. Ward, who was appointed to the survey of South Travancore, and co-operated with him in defining the disputed boundaries of the Travancore and Madras Collectorates [107–8]. In 1821...I was transferred to the survey of the Southern Mahratta States[3], and in 1822 to your department.
>
> From the year 1805 to...1822, I was without any intermission actively employed, ... subject to the inclemencies of weather, dangers, privations, and difficulties attendant on a surveyor while employed in the field, more especially when I was employed on the surveys of the Dindigul district and the disputed boundaries of the Travancore and Madura Collectorates, tracts of the most wild and intricate nature, containing one continued forest. No just conception could be formed by any excepting those who had a share in it[4].

It was because of this rough life that the early marriage of young surveyors was discouraged, even as in later days, and Mackenzie regretted to hear that

> the lad Barnett proposed to marry. As he is an apprentice of the Company under age, the Clergyman ought to be warned not to marry him, as it may be ruinous to the lad. The best way is to remove him to Guntoor, or even to Cuttack[5].

Barnett was already at work in the Circārs, and married at Masulipatam the following year [384]. The marriage did not prove so ruinous, for he was holding charge of a survey party with success some 25 years later.

What with deaths and other casualties, the number of these assistants remaining under the Surveyor General's orders was reduced to eleven by 1822. Lambton had three others. For his survey of the Nīlgiri mountains, Ward had only Keyes and McMahon, who had made the pioneer survey there in 1812 [II, 147–9]. Snell in the Circārs had Dunigan, Faulkner, Barnett, and Anderson ; whilst Hill, Long, Chamarett, and Ficker, were left in Hyderābād.

The return of John Malcolm was welcomed. His career is of some interest, as he was probably a natural son of the great Sir John [II, 173–5]. He took leave from the Hyderābād survey in 1819 "to proceed on his private affairs to Hindostan", and, without permission from the Surveyor General or the Madras Government, obtained a commission as "local cornet" in Skinners' Horse[6]. He resigned this commission in 1822, and was re-admitted to the Madras survey establishment "without prejudice to his rank"[7].

He was employed at Madras from about February 1823, till in October 1824 he was sent to the Malabar survey, with the record of "very bad work...in the drawing office. ... To be strictly supervised in the field". After various delays in the sea passage via Colombo, he reached Cannanore on 25th December.

Ward had taken leave from Malabar in September 1824, and George Arthur who relieved him had to take sick leave to England almost at once. Keyes took over charge but had been sick for some time, and died in January 1825[8], so McMahon and

[1] 10 *ps* to Lawrence ; Rs. 10 to Pope's widow ; Rs. 30-10 to families of Lantwar & Pereira. [2] DDn. 149 (114), 7–4–20. [3] joined Deccan Survey 27–2–21. [4] to DSG. Bombay, DDn. 285 (52), 11–1–34. [5] DDn. 156 (340), 17–4–18. [6] dated 1–1–19, Hodson, IV (573) ; DDn. 149 (3), 25–3–19 & 194 (67–8), 26–4–22. [7] MMC. 16–4–22 ; DDn. 194 (89) ; BGO., C-in-C., 12–6–22. [8] widow, Ecclesia, granted pension Rs. 12 pm. DDn. 218 (156), 3–5–26 ; d. 15–11–37, aged 36 years 10 mo. ; governess, Blacktown Female Orphan Asylum.

Malcolm were left to carry on till Ward's return in December. Malcolm was discharged in 1829 owing to

the debilitated state of his constitution, brought on originally...from repeated attacks of fever, and latterly...from a habit of intemperance, which may unfortunately have been produced from the original cause of his debility. ... The situation...is similar in some respects to that of a late pensioned surveyor, Peter Lawrence, ... to whom pension of 10 pagodas a month was granted [379]. ... Malcolm has only reached the 2nd class, on a salary of 35 pagodas a month, and...his conduct has, until lately, been entirely approved of. ... Although he has no claim thereto by the regulations, ... yet, as he originally lost his health whilst in the execution of his duty, ... he may be considered...for the favourable consideration of Government[1].

He was granted a pension of Rs. 30 p.m. on the grounds that "his constitution has been undermined by repeated attacks of fever contracted whilst in the performance of his duty in the unhealthy country of Wynaad" [114][2].

Mackenzie was firmly convinced that no survey unit could be efficiently run by a country-born assistant [359]. He did not think Dunigan fit for charge in the Northern Circārs after Scott's move to Bengal, and was not happy until he had secured a military officer for charge of the surveys in the Circārs [339–40].

In 1826 Dunigan retired on pension; "from the defective state of sight, his drawings have lately been completed by the other assistants";

From the expiration of the apprenticeship...up to the date of which he was recommended for an increase of pay from 25 to 35 pagodas per mensem, he seems to have given perfect satisfaction. ... He was in charge of the survey in the Ceded Districts, ... which...he conducted and brought to a close in a very satisfactory manner [II, 155].

On the conclusion of that work, in May 1815, he was brought to the Presidency and employed in this office upwards of two years, during which...he manifested a very turbulent disposition, whereby he incurred the displeasure of the late Col. Mackenzie, ... which...was in some extent the cause of his promotion having been so long delayed. ...

For a length of time he did not discharge his duties zealously, or give that satisfaction to his superiors so very desirable. ... He has already suffered for his delinquencies by his promotion having been kept back for upwards of five years, and...his immediate superior, Captain Snell, testifies...that he has no reason to be dissatisfied with his conduct[3].

He was granted pension at half salary, amounting to Rs. 157-8 p.m., and subsequently re-employed at the Madras office.

In the intervals between the unfortunate deaths of the officers who held charge of the Hyderābād Survey between 1820 and 1823, it fell to Thomas Hill to hold charge for several months, which he did most satisfactorily, though in 1822 Young, who had recently taken charge, complained of a letter from Hill

as being disrespectful to me, and I therefore desired Mr. Hill to withdraw the letter entirely. This he...refused to do, and even went so far as to tell me to withdraw my letter to him. ... For this seditious language I ordered him home to his quarters, and wrote to him...that I should stop 20 rupees a month from his pay until he withdraw the objectionable letter. ... This he refused to do, and...he has ever since absented himself from office. ...

I must particularly request that Mr. Hill may not be removed from this survey. He is the only assistant who can print and sketch maps on a small scale. ... It has been my endeavour to conciliate all the assistants to the utmost in my power[4].

In spite of these strictures Hill continued to give worthy service until February 1830, when he was granted a pension of Rs. 78–12 p.m.[5]

During season 1825–6 both the Hyderābād and Circārs surveys were closed down, Crisp being on duty in Calcutta [309–10], and Snell on a sea voyage for his health. The assistants of both parties were brought down to Madras to push on the fair mapping [321], and much resented the loss of their field allowances, the rule being "that surveyors are, at the Presidency, to get no more than 25 pagodas", whereas life at the Presidency must have been a great deal more expensive than in the *mofasil*. Montgomerie apologised for forwarding their petition;

I would not have been the channel of such an address...had I not considered it necessary that Government should be made acquainted with the unjustly discontented and litigious

[1] DDn. 237 (176–7), 11–8–29. [2] ib. (187), 25–8–29. [3] from DSG.; DDn. 218 (163–4), 22–6–26.
[4] DDn. 194 (169), 22–9–22. [5] DDn. 237 (193), 9–2–30.

spirit which...is manifested. ... That the parties should have dared, ... in the face of records of this office, to support their claims by statements and assertions which they must have known to be false, is not more surprising than reprehensible, ... more particularly with respect to senior assistant Dunnigan, who must have been fully aware that the regulations had been enforced, not only with respect to reduction of salaries, but also that field allowances never were granted to any surveyor when employed at this office[1].

Government ruled that they should draw Rs. 122-8 p.m. whilst at the Presidency, equivalent to the higher salary, 35 *ps.* [II, 349]. The Hyderābād assistants were not satisfied, and in November refused to leave Madras unless also granted field allowances, and Montgomerie reports that

on the 2nd instant the...Assistant Surveyors[2] delivered to me a letter...refusing to obey orders they had received, but as I considered the measure a gross attempt to obtain what they were by no means entitled to, they were informed that the letter could not be submitted...and were desired to prepare themselves for the march, and that an advance of 2½ months field pay and allowances would be applied for. But on the acquittance rolls...for that advance being...presented to them for signature, and on being informed of the likely consequences of such disobedience of orders, they said they would stand the result[3].

Government replied that, as they had received their lawful dues, they would be dismissed the service if after seven days they should still refuse to start[4]. There was no further trouble, and, except for Ficker who died at Madras on 28th December, they reached Hyderābād on 17th January 1827.

Thomas Hill, on the other hand, was allowed full field allowances whilst at Calcutta during the same period [118], his move to another Presidency being temporary, and it being considered a hardship that

he should suffer any diminuation of salary and the total abridgement of his field allowances when necessitated to quit his station on public duty; to live in a state of separation from his family, and thus become involved in the extraordinary expence of double maintenance. ... The uniform zeal, ability, and good conduct displayed by Mr. Hill during the three years that his duties have been performed under my superintendence, and indeed the general good character as a surveyor which he has borne for the period of 23 years of a active service, induce me to recommend his application[5].

He was allowed to draw a sum equivalent to his field allowances from the date of his embarkation from Madras in 1826 to Calcutta to that of his arrival at Masulipatam on his return. Mr. Hill's claims to the difference between field and garrison pay and allowances during the time he remained at Madras is inadmissable[6].

To replace casualties Mackenzie had tried to get a survey school started at the Madras office. For various reasons this was not possible though a special school was started in 1819 by De Havilland for surveyors required by the Revenue Board[7]. In 1822 authority was obtained to recruit a couple of apprentices, and more were obtained the following year, when Turnbull was brought into headquarters as instructor[8]. Of these Charles Joseph who had insufficient knowledge of English to qualify as surveyor proved a valuable draughtsman [321]. Augustus Meneaud had acquired "sufficient knowledge of his duties" to be sent to Malabar in October 1826, and Charles Summers, son of that useful surveyor James [374–5], took Dunigan's place at Vizagapatam in January 1827 [376].

In 1827 Montgomerie called attention to the urgent necessity of replacing casualties, and asked that he might recruit twelve more apprentices [321];

There being now only seven of the old Revenue Surveying School available for field service, ... a considerable increase would appear necessary. ... The present weak state of the parties renders the surveys much more expensive then if they were of a proper strength for, as the superintendent of a survey can with ease and advantage fully employ six persons of that description, any number below that...occasions a proportionate loss[9].

Sanction was given, and in September 1828 Montgomerie had altogether 14 apprentices being trained under Turnbull. Another six were entertained in 1830.

[1] DDn. 237 (134), 17–5–26. [2] Chamarett, Long, Ficker, Britain. [3] ib. (290), 9–11–26. [4] MMC. 1–12–26 ; DDn. 218 (296–7). [5] from Crisp ; DDn. 147 (359), 16–10–26. [6] MMC. 28–10–28 ; DDn. 184 (489). [7] M Rev Bd., 830/1819 (7302–3), 23–8–19 & 890/1821 (6519–27), 19–7–21. [8] DDn. 200 (51,200), 15–5–& 27–11–23 ; MMC. 27–9–22 ; C. A. Summers, J. C. Joseph ; MMC. 12–8–23 (24–5), Britain, Joseph, Meneaud, Rodrigues, Wm. Ignatio. [9] DDn. 232 (2), 12–1–27 ; MMC. 27–2–27 (84–5).

The old scale of allowances sanctioned in 1807 [II, 349], based on salaries of 25, 35 and 45 *pagodas*, with tent and horse allowances, and pay and *batta* of lascars, had brought the monthly scale to rupees 122–8, 156–10–11, and 191–10–11 respectively. In March 1830 the regulations were revised. Designation for all grades was to be Sub-Assistant Surveyor, that of Native Surveyors being abolished.

The establishment to be divided into three classes. The first Class to be limited in number to four. The 2nd Class to be an equal number, and the 3rd Class to such number as may be required; the whole to be denominated Sub-Assistant Surveyors. The following salaries and allowances are fixed for the several classes.—

A Sub-Assistant Surveyor, 3rd Class			
Salary	Rs. 60–00–00		
Horse Allowance	15–12–00		
Tent Allowance	24–08–00		
Three Surveying Lascars ...	28–14–11	Total Rupees ...	129–02–11
A Sub-Assistant Surveyor, 2nd Class ...	„ 100–00–00		
Allowances	79–10–11	„ „ ...	179–10–11
A Sub-Assistant Surveyor 1st Class ...	„ 145–00–00		
Allowances	79–10–11	„ „ ...	224–10–11

The period of apprenticeship before appointment as Sub-Assistant was to be seven years, and, as soon as they were fit for field work, the officers under whom they were posted could draw Rs. 28 salary and Rs. 40–4–8 allowances for each[1]. The following is the roll as it stood in February 1830 ;

1st Class
Charles McMahon, Malabar
Andrew Chamarett, Hyderābād
Richard Long, Hyderābād
one vacancy

2nd Class
Charles Barnett, Circārs
Richd. Henry Britain, Hyderābād
two vacancies

3rd Class
Augustus Menaud, Malabar
Charles Summers, Circārs
William Ignatio, Hyderābād

Apprentices[2]
John Summers
Wm. Henry Turnbull
Henry Parlby

GREAT TRIGONOMETRICAL SURVEY

Lambton made the following report on his assistants in January 1816 ;

Joshua De Penning. Age 31. Salary pags. 45. Writes elegantly. Thoroughly acquainted with all the various computations requisite in geodetical operations. An accurate observer, and competent to all the astronomical calculations necessary in the survey under my directions. Draws all kinds of plans well. The plain table he has nothing to do with, it not being an instrument used in this survey. He speaks the Tamil language, and understands Gentoo and Hindostanee. His character is universally good.

Peter Lawrence. Age 33. Salary pags. 35. Nearly the same...in all respects.

Joseph Olliver. Age 30. Salary pags. 35. Employed in all the higher computations, and is making great progress towards all the qualifications above stated.

Willam Rossenrode. Age 24. Salary pags. 25. The same in all respects as the last.

Remark. ... These young men have been chiefly instructed in the various branches of this survey, most of which are complicated and tedious, and different in their nature from those of the ordinary ones; but, whenever this may be completed, and their services employed upon a different scale, all other descriptions of surveys with common theodolites, plain tables, etc., must soon become easy and familiar to them. I...hope, when my labours are at an end, that young men possessing such attainments as they possess, particularly the two first, may be employed on surveys of a more general nature, from which Geography may derive advantage, and for which they will be so eminently qualified[3].

The following year Lambton had to ask for Lawrence's dismissal;

I had always considered him of a weakly constitution, and attributed his not attending at my office occasionally to ill health, till the instances became so frequent that I began to

[1] DDn. 328 (9), 17–2–30. [2] Other apprentices engaged before 1830 include Colin Ignatio, Wm. Martin. Wm. Parr, Francis Boyne, Thos. Butfoy, Edward McCarthy, Wm. Orrock, Whitelaw Daly, John Leigh.
[3] DDn. 63 (375), 22–1–16.

suspect his being given to drinking, and, ... my apprehensions were too well founded, and he is now in such an emaciated state that he can scarcely hold a pen in his hand. As this is the third chance that I have given him, ... and being at this moment in a state of intoxication in his quarters, I should be remiss in my duty were I not to report his incapacity. ...

On account of his former valuable services for at least *fifteen years*, it becomes equally my duty to recommend...that he may be allowed wherewith to maintain himself and family, he having a wife and five small children who look to him for support[1].

Lawrence was removed from the trigonometrical survey from 1st January 1818 and, given a pension of ten *pagodas* a month from May 1818. Much to Mackenzie's disgust, he was employed in the drawing office till October 1820 when discharged after relapses of drinking. He did excellent work, however, on the pendulum observations at the equator during 1822–3 [255].

Being asked what changes he wanted made in his establishment on his transfer to the Supreme Government, Lambton asked that his staff of assistants should be raised to six, and that substantial increases of pay and allowances should be granted to the three seniors [324] ;

In a survey of this kind, where every individual must be prepared to move rapidly over a great extent, it is absolutely necessary that they should keep up an efficient establishment, and...must frequently leave their families behind...for several months together, which obliges them to have a double establishment. The expenses...must therefore be very great. ...

The instruction of these young men, after they came to me...must give them a pre-eminence over the ordinary class of surveyors. ... They soon become expert calculators. ... They are then taught...the use of all my grand instruments ; to adjust them, and to observe, which they do with great accuracy. ... Joshua De Penning was so fully qualified in 1813 that I entrusted him to carry a belt of triangles, principal and secondary, ... entirely across the Peninsula, and he accomplished his task in a most masterly manner [246–8]. ...

Mr. De Penning stands in a very superior light, both as to his attainments and the respectability of his character. He is competent to the practical part of the survey in all its various branches ; thoroughly acquainted with the adjustments of all my instruments ; is an excellent practical astronomer[2].

If their allowances are not increased so as to enable them to support their families, it would be impossible for them to attend me through different countries, and it will be equally impossible for me to go on without them. In which case my operations must either be confined to this part of India, or be relinquished altogether. ...

I...recommend that a salary of four hundred (400) sicca rupees per mensem be granted to Mr. Joshua De Penning, and two hundred and fifty (250) to each of the others for the present, leaving an opening for their rise according to their talents and behaviour. These allowances are to include all allowances for horses, tents, etc., which are now specified in my monthly abstract [II, 335 ; III, 325]. ...

Three more Sub-Assistants should be added to my present establishment, so as to augment the number to six. ... Their pay for the *first three years* should be one hundred and seven (107) ; *for the second three years* one hundred and forty (140), and for the *third three years* one hundred and seventy three (173) sicca rupees per mensem, and after that to rise according to their merit. The young hands...are much wanted for copying reports, etc., ... the older ones ...in calculations. Copying and collating take up a vast deal of time [255–6][3].

These recommendations were first made in November 1817, and were referred to Mackenzie, who put them aside. He could not see why the assistants of the trigonometrical survey should have better terms than those of his own establishment. It was not till after his death that Hodgson took the matter up, and obtained sanction to Lambton's proposals as they stood. A further reference from Lambton brought retrospective effect from 1st January 1818[4] [325].

Two recruits were appointed in July 1821 ;

William Lambton, a natural son of mine, is just from school, and is quite prepared to be instructed in the elements of his profession. ... Joseph De Penning, a son of Mr. Joshua De Penning, my first Sub-Assistant, is also a promising lad and under his father's instructions will ...soon become acquainted with the necessary rudiments[5].

The third recruit, Murray Torrick, was appointed from 22nd April 1822. After

[1] DDn. 63 (421–2), 2–10–17. [2] ib. (426), 27–11–17. [3] DDn. 92 (144), 31–8–20. [4] BPC. 2–6–21 & DDn. 92 (194–6), 17–7–21. [5] to Gen. Dept. DDn. 92 (197), 30–7–21.

Lambton's death his son was sent back to school as far too young for service, and Joseph De Penning was discharged two years later [326].

A serious loss was the resignation of Joshua De Penning, who asked to resign immediately after Lambton's death on the grounds of health and reluctance to accompany the survey to Upper India. Everest tried to persuade him to stay ;

His application to resign at the present time, when he must know that Superintendent has urgent need of his services is, I fear, the result of caprice, and I hope that...he will not think of leaving the survey until the Superintendent can conveniently dispense with his services.

If, however, Mr. De Penning should really, from his long and active service in the field, have suffered so seriously in his health and constitution as to prevent his farther exertions here, I think that the reasons for granting to him the liberal salary he now receives...will cease to exist, and he could then be considered in no other light than as an Assistant Surveyor of the First Class, with his salary as such on the Madras Establishment, and entitled to his pension on half pay in the event of his retiring.

However, if incapable of field duty, he might still, I think, be advantageously employed in the office of the Assistant Surveyor General at Madras[1].

A month later, however, Everest reported that De Penning would stay

until my whole party can assemble in the latter end of this year at Ellichpoor, and I...solicit... permission...for Mr. De Penning to resign...from the 1st February 1824, and for Mr. Joseph Olliver to succeed to the vacancy from the same date. ...

During the time that I have been with this survey his exertions have been unremitted, and have ever entitled him to the highest consideration of the late Superintendent. ... In the various climates under which he has had to act...his constitution has been so much impaired as not to admit, in his own opinion, of his remaining longer in this part of the country. ... After a long and meritorious service of 23 years, he wishes to retire to the coast with his family, and it is with the most sincere gratification that I beg to recommend his case[2].

After holding charge of the detachment at Nāgpur during the rains of 1823, De Penning joined Everest near Ellichpur, and after assisting with the measurement of the base at Tākarkhera, resigned from 1st February 1824, being allowed to draw salary till the end of March to cover his journey down to the Coast. He was struck off the strength of the Great Trigonometrical Survey with a pension, reverted to his former situation and pay under the Madras Government, and was employed in the Surveyor General's office at that Presidency.

After the discharge of young Lambton, Everest recruited a boy named John Peyton, son of the senior surgeon at Hyderābād, and he reports later that

Joseph De Penning is a very well-disposed, obedient, and steady lad, and as mere underclerk I would not desire any person more effective but, poor lad, he is very dull, and in the field has as yet evinced no symptoms of practical talent whatever[3]. ...

Murray Torrick is not only a very incapable and ignorant young man, but inert beyond all conception. He can by no means be urged to his duty, and during the whole of my last operations has been of no use to me whatever. ...

John Peyton has not been...long enough in the department to be judged ; I sincerely hope he will in time be useful, and as he is the son of one of my particular friends I shall be most happy to make favourable mention of him whenever I have an opportunity.

As to my two principal sub-assistants, they are truly efficient in all respects[4].

Blacker held out no hope of finding a suitable substitute for Torrick ;

Insuperable difficulty will attend all endeavours to procure such a substitute...if I am to judge from my own ill success in supplying the Surveyor General's Office with servants. ... I see no method of being supplied with such assistants except by apprenticing youths from the Orphan School, who have yet to learn almost every qualification you enumerate[5].

Everest agreed to give him a further trial ;

I shall make the most I can of the Sub-Assistants whom I have. ... This young man' has shewn considerable symptoms of amendment of late, & begins to be more useful and obedient.

In reference generally to the Sub-Assistants of my department, ... I have not perhaps much reason to be dissatisfied, but the contrary. Accustomed, however, as I have been, in following up the system of my great predecessor, to lead them to their duty by kindness alone, I am utterly unacquainted with the extend of authority which the law allows me, and have

[1] to SG. ; DDn. 198 (36), 30-4-23. [2] DDn. 171 (22), 28-5-23. [3] discharged, Nov. 1825. [4] DDn. 171 (261), 29-7-24. [5] DDn. 220 (58), 9-10-24.

no means of protecting myself against those whims and caprices, of which I this day submitted to you a lamentable instance in the case of Mr. Olliver.

The trouble with Olliver was an unfortunate instance of Everest's hasty temper and impatience, which from time to time overwhelmed him. Repeated attacks of fever, and the strain of carrying on a difficult professional task which would have severely taxed the physical strength of a man in perfect health, had brought him to a most neurotic state [403–4]. He had a sharp attack of fever just as he was starting work on his base-line at Sironj [245–6], and sent a peremptory message for Olliver to come to his assistance. Olliver, who was engaged on triangulation a few miles away, failed to come as ordered, and Everest straightway accused him of insubordination, and placed him under arrest in such a tactless manner as led Olliver, who was really the most loyal of servants, to an obstinate opposition. The matter was reported to Blacker whose tactful handling of the case eventually led to reconciliation. Everest replied to Blacker's letter that,

on receipt of it, I sent for Mr. Olliver and, after having read the contents to him, I released him from arrest, and desired him to return to his duty, allowing him 3 days to consider what answer I should return. On the 3rd day...he waited upon me and expressed his sorrow and regret for what had passed, and his thanks for the considerate treatment which he had experienced, both at your hands and mine. ... I will...consider the affair as satisfactorily settled[1].

Whilst short handed with Olliver under arrest, Everest asked the local military commander for help, and was fortunate to find in Gunner, or Bombadier, Fisher a man who was able to give most welcome assistance for several months. In describing his measurement of the Sironj base-line Everest reports that

Gunner Fisher...very soon become tolerably expert in those parts of the duty which I required from him. He was very alert and soon made himself useful. He is a young man far above the common class of European soldiers, and is...respectably educated. He has some knowledge...of mathematics. ... He has a very tolerable practical knowledge of the use of logarithms, and is able to apply the formula for...difference of level, and hypothenusal deduction of the base, with considerable celerity, all of which requires care and some skill.

I feel quite loth to recommend any person to your notice since the lamentable conduct of my first Sub-Assistant, but [I recommend] appointing Gunner Fisher temporarily to my department as a 3rd Sub-Assistant upon the usual allowance of 107 rupees a month, to commence from the 27th Novr. 1824. ... My department is much crippled for want of persons who can afford me even common assistance in my extensive calculations[2].

The appointment was sanctioned[3], but Fisher was disgusted at being reverted to his unit when Everest closed down work a few months later;

When Captain Everest...was in the act of the measurement of a base...near Serong, he found it...necessary to apply to Major General Arnold, commanding at Saugur, for a person ...to assist him in his operations, as Mr. Olliver was placed under arrest. I was the person sent out, when it is well known to the station doctor at Saugur I was not able even to walk one mile in 6 hours. Three months I had been ill with the fever and ague. ... I reached the Captain on the day appointed by forcing my marches, and went to duty immediately. ...

Captain Everest is...well aware that by my temporary appointment I was deprived of a permanent one [under my] patron the Lord Bishop of Calcutta. However, he gave me such hopes, adding always, "only be satisfied with being temporarily appointed", and I should be permanent "if in his power". Rome, he had to tell me, was not built in one day. ...

I have not, I trust, been found unfit to fill the situation of 3rd Sub-Assistant. ... I am prepared for a fair examination in those sciences, geometry, trigonometry, &c., on which the whole art of surveying depends. Captain Everest is well aware, out of the 5 Sub-Assistants, 3 of them are of little or no use, and...Mr. Olliver and Mr. Rossenrode little better. They can calculate plane triangles in some cases, but not general.

Anything you may be pleased to confer on me, so that I may be removed from barracks, will cause...humble, heartfelt, gratitude. I was recommended to Government in the year 1822 by W. Fraser Esq. at Delhi for the surveying department [151], but Captain J. A. Hodgson, the Surveyor General, said there was no vacancy[4].

Barrack life in India in those days must indeed have been irksome to a man with any education at all, and it is possible that Fisher found congenial employment with the aid of his patron the Bishop; he was not taken into the Survey.

[1] DDn. 171 (316), 12–2–25. [2] ib. (208), 25–12–24. [3] BMC. 11–3–25 ; DDn. 201 (39). [4] DDn. 171 (423–4), 28–9–25.

After Everest's departure, Olliver was promoted to Rs. 300 from 11th November 1825, and left in charge with Rossenrode, Torrick and Peyton. He reports a year later that Peyton was " very quick of comprehension, and by no means tender in encountering difficulties when subject to hardships ".

Mr. M. Torrick...has also made a judicious selection of one station during the last trip, ... a mere chance for, though he made the selection, he was quite at a stand afterwards, and, from the very distressing description he gave of the features of the country for further proceeding, so much discouraged me that I then accounted it an unfavorable selection. ... He is naturally very slow of comprehension. ...

Both the 3rd Sub-Assistants are very useful in the calculations, such as the probabilities of error in the observed angles, the chord corrections, and spherical excess, and the calculation of the triangles. It remains yet to qualify them for the more intricate calculations[1].

Olliver, whom Everest had described as his "right arm", both on his operations east of Hyderābād in 1819–20 and on his western series towards Poona in 1822–3 [230, 234–6], held charge of the Calcutta Longitudinal Series between 1825 and 1832, and continued to do noble service till his retirement in 1842, besides giving three sons to the survey. Rossenrode also was a most valuable worker, and gave loyal and capable service till his retirement in 1841, leaving two sons in the survey, one of whom held independent charge of a party for many years. Everest records that,

at the death of Lieut. Colonel Lambton in January 1823, Mr. Rossenrode was anxious to quit the department, but at my persuasion over-looked the severe sufferings he had already undergone, and consented to encounter again the same hazards, rather than expose the operations of the Great Arc to a failure from want of his able assistance. ...

He was then a hale active man in the prime of life, with all his faculties unimpaired. His natural intelligence, which is of a high order—his conciliatory deportment in his dealings with natives, which acquired for him an influence such as I never seen equalled—his familiar command of most of the native dialects from Cape Comorin to the Himalaya mountains—his general and almost imperturbable good temper—and his aptitude for business—peculiarly qualified him to succeed in a mercantile capacity, and had he then yielded to the instances of his friends...he would have had every prospect of ultimately surmounting the evils for which repeated attacks of jungle fever had already laid the foundation. ...

By continuing with the department Mr. Rossenrode was of the greatest service to me in conducting the...Great Arc across the mountain tracts between Sironj and Ellichpur, and... I have little hesitation in saying that but for his valuable aid all my efforts to bring the Great Arc series to Seronj would have ended in failure [245].

At my departure for England in 1825 on sick certificate, Mr. Rossenrode was employed in conjunction with Mr. Olliver in conducting the Calcutta Longitudinal Series, ... but here again...he suffered most severely from the effects of jungle fever, and his former illness became now confirmed, so as never afterwards to be eradicated[2].

BOMBAY

The first civilian assistants employed in the Bombay Presidency, other than Indian revenue surveyors, were William Webbe and William Sundt. Webbe was the half-caste son of a British sergeant, and was apprenticed and educated at the Madras surveying school [I, 284]. He had accompanied both Malcolm's missions to Persia as surveyor—1799 to 1801 and 1809–10—and compiled the maps [II, 176, 280]. In October 1812 he was transferred to the Bombay establishment, and worked under Williams on the revision of Reynolds' great map [II, 284]. Sundt also had been a protégé of Malcolm's ;

Mr. Sundt, who is the son of a Captain on the Madras Establishment, left the Orphan Asylum of that Presidency to enter the Quarter-Master-General's Office in 1806, in which he was employed as Surveyor and Draughtsman. He was while in this line on field service in Travancore [II, 131–2]. In 1809 he went with me to Persia, and in 1812 was transferred by me to this establishment, along with Mr. Webb, as a Surveyor in the Revenue Department [II, 188].

In 1818 he was...directed to...my orders, and has since...been most actively and usefully

[1] DDn. 174 (36), 3–1–27. [2] DDn. 402 (158–9), 12–6–41.

employed[1]. ... This ingenious and able man could have had higher allowances...if he had gone to Poona, but his zeal and anxiety to finish what he is now employed on here [Bombay] made him remain on a less sum. He is not merely an excellent draughtsman and correct surveyor, but a man of general attainments, and of considerable science[2].

Sundt was paid Rs. 120 p.m. in addition to his former salary of Rs. 152 as revenue surveyor. Of the work on his map of Malwa [275], Malcolm further writes ;

Mr. Sundt (a native born), who was lent to the Geographical Department in Central India from the Revenue Survey at Bombay to which he belongs, not only drew the original map, to which he contributed several surveys [85–6], but has since made a copy with divisions of Districts, and has completed a geographical index. ... Some information regarding the navigation and traffic of the Nerbudda was communicated by Mr. Webb, who is also a native born, and belongs to the same survey as Mr. Sundt.

The author has particular pleasure in stating his obligations to these ingenious and scientific persons, with whose labours in the public service he has been intimately acquainted from the time they left the Survey School at Madras[3].

Sundt continued work on Malcolm's map till its completion early in 1822, and on Malcolm's recommendation was allowed an "additional remuneration" of Rs. 1600 ;

I brought to Bombay materials for making an improved copy of my Map of Malwa, and for completing an index of all the towns and villages that are included in it. ... The Index... now contains an account of nearly seven thousand places. The magnitude of this index and the great labour necessary for defining the boundaries of the pergunnahs in the map will make it at least three months before the whole can be finished. ... I trust the charge of completing this task may be left with Mr. Sundt, ... and I cannot refrain from bringing...his long meritorious services to the notice of the Governor in Council[4].

After Williams' departure both Webbe and Sundt reverted to the Gujarāt Revenue Survey, and Cruikshank was most reluctant to surrender them to Sutherland when he became Assistant Surveyor General ;

Since the mode of carrying on the Revenue Surveys by means of a large establishment of native measurers has been adopted, the work, instead of being confined to one purgunna as formerly has been extended to all the three remaining collectorships of Goojerat, and as these natives, although perfectly competent to perform the outdoor duty, are unable to draw at all, the utmost exertions of the officers and of all the other draughtsmen are requisite to prevent this part of the business from falling into arrears. ...

This has already occasioned an accumulation of the drawing part of the duty beyond the power of the European Officers to complete without delaying the surveys, and it can only be finished with the assistance of Messrs. Webb and Sundt. ...

The charge of the office in Broach, where the drawing is carried on, then devolves on Mr. Webb whose conduct and good example are fully required to regulate...the establishment thus left under him, which generally consists of one or two draughtsmen, an European apprentice, and some native writers. And, in the event of any young men or boys from the schools in Bombay being attached to this Department for...instruction, ... their doing well must chiefly depend on the present means of instructing and taking care of them[5].

The surrender had, however, to be made, though Webbe was retained till March 1823 to complete a copy of Malcolm's map for the Resident with Holkar[6].

Two other surveyors, or draughtsmen, were employed on Malcolm's maps[7], Arthur or Alexander White, who, with James Evers was later employed in Khāndesh by Briggs [124], and L. I. De Mello. It was possibly one of these about whom St. John Blacker wrote from Sindhia's camp in April 1818 [85] ;

A draftsman whom I have employed in Cochin to make a survey of that country has followed me here. This person has been instructed in all the necessary branches of mathematics to perfect him as a surveyor, in which capacity he has been employed for these ten years in Travancore and Cochin, partly under the superintendence of an Engineer officer[8].

Blacker asked that he might employ this man in Central India, and draw allowance for purchase of stationery, and also a perambulator for the survey. In a later letter he says that he lent this surveyor to Malcolm for mapping[9].

[1] from Malcolm, 30–11–21, Bo RC. 5/5 (289–92). [2] from Malcolm, 25–11–19 ; DDn. 145 (1). [3] Malcolm, II (appx. i). [4] 30–11–21 ; Bo RC. 5/5 (289–92). [5] from Cruikshank, 20–6–22. [6] Bo MC. (camp), 59/1822, 18–9–22. [7] MRIO. 83 (67–8), 84 (1–8) : hills boldly drawn with little detail. [8] Arthur employed a lad named White in Mysore [II, 378 n.4] and possibly took him to Travancore [II, 131–2]. [9] DDn. 144 (379), 7–4–18 & (377), 12–10–19.

In proposing an Assistant Surveyor General for Bombay in 1821, Hodgson had suggested a school for country-born surveyors. This was taken up with enthusiasm by the Chief Engineer, and accepted by the Government ;

With reference to the...formation of an institution for the instruction of charity boys in survey duties, ... the Hon'ble the Governor in Council has it in contemplation to graft on that Institution an establishment for the purposes of teaching boys born in the country, of European parentage, the lower branches of science and mechanical arts, so as to render them useful in superintending works under European Engineers. ... An officer of the corps of Engineers should be appointed Superintendent of the establishment[1].

Under a General Order of 18th April 1823, George Jervis, of Engineers, was appointed Superintendent of this school, but it was some time before any of its pupils became available. Possibly Price and Sanger who joined the Deccan Survey on 1st May 1826 were amongst the first. Some of the Bombay maps about 1830 are beautifully drawn by William Bertie and J. Hanson, draughtsmen in Jopp's office, who may have come from Jervis' school[2], which was started in Bombay where at one time it had as many as 79 pupils under tuition. On Jervis's transfer to Poona in 1830, the school accompanied him.

Not only were instructions in mathematics, drawing, surveying, and practical mechanics given, but the Superintendent had placed at his disposal the litho presses...sent out by the Court of Directors since 1822 [298]. ... The Engineer's presses, both at Bombay and Poona, have turned out work nearly as good as the climate allows. ...

The Establishment...came into existence 30 years too soon, and was maintained in a state of prosperity solely by the zeal of Capt. Jervis, its founder. ... A few years afterwards it disappeared from the list of our educational establishments, and the books, instruments, drawing materials and scientific apparatus belonging to it have long lain...inches thick in dust[3].

In Bombay ; a number of Indian surveyors were employed on the revenue surveys and with Thomas Jervis in South Konkan [393].

NOMINAL ROLL, MADRAS

Name	Birth & Death	Apprenticed	Employment	Domestic
AIKIN, James [II, 350]	b. c. Oct. 1789 d. 1849	1803	Dindigul, 1815 ; Travancore, Oct. 1817 ; to Bombay est., Feb. 1821 [125].	
ANDERSON, Thos. [II, 350]	b. c. June 1796	1810	SGO. Madras, 1812 ; Circārs, Nov. 1815 ; Guntūr, 1817 ; Mslptm. 1820 ; Vizagptm., 1829 : omitted from 1830 list.	m. before April 1824.
BAILLIE, Chas. [II, 350]	b. c. Sept. 1785 d. 3-12-20	1798	SGO. Madras, 1815 ; MMI. Jan. June, 1816.	
BARNETT, Chas. [II, 350]	b. 1-3-1800	1809	SGO. Madras, 1815 ; N. Circārs, Nov. 1815-1832 ; Nellore, 1833-43.	m., Mslptm., 1-11-19, Miss Leonora Hudson.
An apprentice H. Barnett, recruited in Madras 1822, d. 24-1-25.				
BIRD, Wm. [II, 351]	b. c. March 1793 d. 30-12-20, Ellore.	1805	Dindigul, 1815 ; Travancore, 1816 ; sick to Presdcy, March 1817 ; absent without leave ; re-adm. Feb. 1818 ; Pondicherry, 1818 ; N. Circārs, 1820.	Left a widow "disconsolate".
BOYNE, Francis	...	1827	Trchply., 1830 ; Hdbd. 1832 ; Salem, 1840 ; GTS. 1841.	m., Bangalore, 10-6-39, Jessié Elizabeth Hayes.
BRITAIN, Richd. Henry	b. c. Feb. 1801	1823	Sub-Asst. at Hdbd. 19-4-23 ; with Hdbd. svy. till 1838.	m., Madras, 3-9-23, Charlotte Chamier, having 8 children at Secndbd.
BURKE, Marcellus [II, 351]	b. c. June 1792	1805	MMI. 1815 ; Circārs, Jan. 1816 ; Guntūr, 1817 ; by land to Bengal, Jan.-March 1818 [371].	m., Calcutta, 22-11-20, Eleanore Meneand, spin.
BUTFOY, Thos. Wm.	d. 12-4-32 Brhmpr. 21 y. 1 mo.	1827	Ganjam, 1830-2.	

[1] Bombay Castle, 10-3-23 ; Bo RC. 98/1823 (116-37). [2] MRIO. 126 (7, 8), etc. [3] *Bo Times Cal & Dir.* 1853 (344).

Name	Birth & Death	Apprenticed	Employment	Domestic
CHAMARETT, Andrew [II, 351]	b. c. March 1793 d. Poona 18-12-48.	1805	Dindigul, 1815; SGO. 1816; Guntūr, 1817; Ellore, 1819; Hdbd. 1820-48.	m., Scndbd. 3-10-20, Katharine Johaness; left son in survey.
DALEY, Whitelaw	...	1827	Hdbd. 1830-43.	
DE PENNING, Joseph	b. c. 1806	1821	3rd Sub-Asst. GTS. 1-7-21; disch. Nov. 1825.	nat. son of Joshua; m. Scndbd., 18-4-37, Elizabeth Prayero.
DE PENNING, Joshua	v. Biographical Notes [III, 437-9] [II, 394-5]			
DUNIGAN, Michael [II, 351]	b. c. May 1784	1798	SGO. May 1815; Guntūr, July 1817; in ch. from Sept. 1818; in ch. Ellore & Mslptm., 1819; N. Circārs, 1820; SGO. 1825-6; pension, 1826; re-emp. SGO. till 1830.	
FAULKNER, John [II, 351]	b. c. March 1785 d. 19-11-21	1803	Sonda, 1815; Coorg, Oct. 1815; Cochin, 1817; Rājahmundry, Guntūr, 1819; sick, Nov. 1820.	pr. son of Condr. Henry Faulkner.
FICKER, Fredk. Richd. [II, 351]	b. c. Dec. 1792	1807	Sonda, 1815; Coorg, Oct. 1815; Cochin, 1817; Hdbd. 1821; SGO. 1825 till death 28-12-26.	m., Chitaldroog, 23-9-15 Amelia Fowler.
HAMILTON, Henry [II, 351]	b. c. May 1786	1800	SGO. Madras, 1815; Circārs, Jan. to March, 1818; Head Dmn., Calcutta, till death, 6-6-26.	
HILL, Thos. [II, 351]	b. c. March 1786 d. Madras, 20-3-46.	1803	SGO. Madras, 1815; Hydbd. June 1816; in tempy. ch. 1820-1, 1823; emb. Madras 8-2-26 to Calcutta, returned Mslptm. 1-1-27; Hdbd. 23-1-27; Palnād, 1829; ret. 9-2-30; SGO. Madras till 1833.	
HOWARD, Robt.	...	1827	Trchply. 1830; Hdbd. 1832; Ganjam, 1844; in ch. 1848-9.	
HOWELL, Wm. [II, 351]	b. c. March 1791	1803	SGO. Madras, 1815; Hdbd. 1816; arrd. Madras, July 1819, for tr. to Bengal; resd. Calcutta, Dec. 1819.	Took wife & family to Bengal and back 1819.
IGNATIO, Colin	...	1827	Hdbd. 1830-46.	Son of C.A.I., Hd. Dmn. [316].
IGNATIO, Wm.	b. c. Nov. 1811	1823	Hdbd. 1830-33 till death in Fd. 30-12-33.	bro. of Colin; m., Scndbd. 30-8-31 Harriet Hill.
KEYES, Wm. [II, 351]	b. c. 1789	1803	Dindigul, 1815; Travancore, Nov. 1816; Dindigul & Coimbatore, 1821-3; Malabar 1824 to death at Cannanore, 23-1-25.	Left widow Ecclesia & 4 children [375 n.8].
LAMBTON, Wm. junr.	v. Biographical Notes.			
LANTWAR, Wm. [II, 352]	d. Madras, 29-5-17	1799 as writer	Asst. survr. 1807; SGO. Madras, 1815 to death.	Son of Maj. Wm. L. [II, 352 n.]; m., Madras, 13-1-10, Bridget Terezia Folliot.
LAWRENCE, Peter [II, 351]	b. c. Aug. 1783 d., Madras, 21-10-27	1789	Lambton's svy., 1800; disch. Jan. 1818; pension 10 *ps.* from 31-5-18; re-emp. SGO. 1818 to Oct. 1820; on pendulum obsns. 1822-3 [255].	m. Sarah; had 5 children in 1817.
LEIGH, John E.	...	1827	Hdbd., 1830-43	
LONG, Richd. [II, 351]	b. 27-7-1793 d., Secndbd. 7-10-55; MI.	1805	Sonda, 1815; Coorg, Oct. 1815; Cochin, 1817; Hdbd., 1821-43; Palnād, 1829.	m., Trichur, 30-12-20, Ann Watts half-?, sister of C. R. McMahon; left son, R. H., in survey.
MCCARTHY, Edward	...	1827	Trchply., 1830; Hdbd., 1832-3.	
MACMAHON, Chas. Robt. [II, 351]	b. c. Oct. 1791	1805	Dindigul, 1815; Travancore, July 1816; Dindigul & Coimbatore, 1821; Malabar, 1824; Madura, April 1830; Salem, 1834-42.	
MALCOLM, John [II, 351]	b. c. March 1793	1807	Sonda, 1815; Hdbd,. June 1816; Local Cornet, Skinner's Horse, Jan. 1819; re-adm. Mad. Svys. 1822; SGO., 1823; Malabar, Dec. 1824; pension, Aug. 1829.	pr. nat. son of Sir John Malcolm, Mad. Inf., Govr. Bombay, 1828-30.
MARTIN, Wm.	...	1827	Ganjam, 1830; to GTS. 1832; resd. 1843.	

NOMINAL ROLL, MADRAS—(*Continued*)

Name	Birth & Death	Appren-ticed	Employment	Domestic
MENEAUD, Augustus	b. c. July 1803	1823	Malabar, Sept. 1826; Madura, April 1830; resd. 1833; re-emp. Salem, 1839–43; Nilgiri svy. 1849–53; Dmn. SGO. Calcutta from 1–1–54.	Son of Auguste M., arrd. Madras from France, 1789; brass founder. m. Matilda before 1832.
OLLIVER, Joseph [II, 352]	v. Biographical Notes [III, 491–2].			
ORROCK, Wm.	...	1827	Madura 1830; Trchply., 1832; pr. to Ceylon, 1833.	
PARLBY, Chas. Henry	d., Hydbd. 5–1–73, MI. aged 62.	1827	Hdbd., 1830–43; Ganjam, 1844.	m., Scndbd., 9–7–36 Sarah Elizabeth O'Leary
PARR, Wm.	...	1827	Madura, 1830; Trchply., 1832; pr. to Ceylon, 1833.	
PEREIRA, Christian [II, 352]	b. c. Nov. 1790,	1803	Dindigul, 1815; Travancore, Nov. 1816 till death, Quilon, 20–7–18.	m. Dec. 1817; widow pensioned.
PETTER, Edw.	...	1830	Trchply. 1832–3; disch. 1834.	
PEYTON, John	v. Biographical Notes [494–5].			
POPE, Sylvester [II, 352]	b. c. April 1781	1794	SGO. Madras, 1815, pension @ 10 *ps.*, 1818 till death, Madras, 25–11–18.	Widow pensioned.
ROBINSON, John [II, 352]	b. c. Jan. 1782	1794	Tinnevelly, 1815; resd. c. 1816; with Tank Dept. c. 1815–25; pendulum obsns. 1822–3.	
RODRIGUEZ, E.	b. c. Aug. 1809	1825	ordered Vizagptm., Jan. 1827; but still at SGO. 1829.	
ROSSENRODE, Wm. [II, 352]	v. Biographical Notes [III, 499].			
SCOTT, Wm. [II, 352]	v. Biographical Notes [501–2].			
SUMMERS, Charles A.	...	1821	Vizagptm., Jan. 1827, Nellore, 1833–43, Ganjam 1844–55.	Son of James.
SUMMERS, James [II, 352]	b. 20–3–1789 d. Madras, 23–12–32	1800	SGO. Madras, 1815; Pondicherry, 1816; Mslptm., Nov. 1816; resd., 1819; pension Rs. 61–4 p.m.; re-emp. SGO. Madras.	Father of Charles & John
SUMMERS, John	...	1825	Circārs; 1829–32; Nellore 1833–6; Goomsur 1836–8.	Son of James [*sup*].
TERRY, John [II, 352]	b. c. April 1792	1805	Sonda, 1815; Guntūr, 1816; Mslptm. 1817; Hdbd., April 1819. till death Sept. 1819.	Left a widow.
TORRICK, Murray	...	1822	GTS.; dsm. 18–4–33.	pr. son of Michael Torrick "Free Trader".
TURNBULL Thos. [II, 352].	v. Biographical Notes [508].			
TURNBULL, Wm. Henry	b. c. Sept. 1810	1827	Hdbd., 1830–50; Ganjam, 1850 to death in fd. 24–4–53.	Son of Thos., m., Scndbd; 14–5–33, Leonora Sarah Ficker.

NOMINAL ROLL, BOMBAY

AIKIN, James [384]	b. c. Oct. 1789 d. 1849	1803	from Madras svys. 1821; Deccan Svy., Dhārwār, 27–2–21; Poona, May 1823; ret. 10–2–1834.	pr. father of Wm.; wife Elizabeth d. Poona, 3–7–25. MI.
AIKIN, Wm.	b. 1811/2	1828	SGO. Poona; disch. 20–2–34.	pr. son of James.
BERTIE, Wm.	b. 1815/6	1828	SGO. Poona; disch. 20–2–34.	
DE COSTA, Joseph	b. 1814/5	1829	clerk, SGO. Poona, 1828; disch. 10–2–34; Sub-Asst. GTS. 1837, serving till 1860.	
EVERS, James	...	...	Khāndesh, 1821–2.	
FRASER, James	d., Poona 15–12–63, aged 58; MI.	1822	Deccan, 1822; Bo. Trig. Svy. 1828; Sub-Asst. GTS. 1834; ret. 1851.	m., before 1838, Isabella.
HANSON, J.	b. 1814/5	1828	SGO. Poona; disch. 1834.	
HORNE, Francis	b. Madras; d., Poona, 16–1–49, aged 56, MI.	...	on svy. N. Konkan under Collr., c. 1819–20.	m., Madras, 28–9–11, Elizabeth Monisse; pr. father of Edw. Horne, dmn. Bo. SGO. 1832–3.
LOWIS, S.	...	...	Bombay Trig. Svy., 1829.	
PRICE, Wm. Samuel	b., Bombay 1811/2	1826	Deccan, May 1826; Bo. Trig. Svy. 1832; resd. 1836; to Rev. Svy.	m. before 1840

Name	Birth & death	Appren-ticed	Employment	Domestic
SANGER, Thos.	...	1826	Deccan, May 1826; Bo. Trig. Svy. 1832; GTS. 1834; Abu Merl. Series GTS. 1856.	
SPRINGER, John Hans	b. 1810; d., Poona, 20-2-61, MI.	1823	Deccan Svy. 1823-34; Deccan Rev. Svy. from 1837.	widow, Joana, d. 1882.
SUNDT, Wm.	...	...	ed. Mil. Orphan Asylum, Madras; QMG.'s office, 1806; Travancore 1808; with Malcolm to Persia, 1809; Broach Rev. Svy. 1812; with Malcolm, Mālwa, 1818; Bombay, 1819; Gujarāt Rev. Svy. 1821; SGO. Poona, 1822-30.	son of either Capt. C. L. S. (1768-91) or J. A. S. (1756-95) both of Mad. Inf., of Danish family of Tranquebar.
WEBBE, Wm. [II, 352, 454]	b. April 1784/5	1794	with Malcolm to Persia, 1799; Madras svys., 1802; Persia, 1809; Goa, 1811; Broach & Reynolds' map, 1812; Malcolm's map, 1818-20; Gujarāt, 1820-3; SGO., Poona, 1823-30.	Son of Sergt. Webbe, Mad. Est.
WHITE, Alex. (Arthur ?)	...	...	pr. with Thos. Arthur on Mysore Svy. 1804 [II, 378], Mālwa, 1818; Khāndesh, 1820-3; CE. Bombay had dmn., named White in 1835.	

As original rolls are far from consistent regarding ages, the dates of birth are not reliable.

CHAPTER XXVII

INDIAN SURVEY PERSONNEL

EDUCATED STAFF; Bengal — Madras — Bombay — LASCARS & FOLLOWERS; Bengal — Madras & Bombay — Great Trigonometrical Survey.

TO prevent their rivals, French, Dutch, and others, from having the use of reliable maps of the country, the Court of Directors had long insisted on the secrecy of maps and surveys [I, 256–9 ; II, 288, 291–2], and restricted the art of survey to their own covenanted or military servants [I, 266 ; II, 340]. On the plea of economy, the employment of Indian explorers, or even uneducated followers, to make reports and sketches was discouraged, and sometimes peremptorily forbidden [I, 286 ; II, 354].

The employment of Indian measurers, *amīns* or *mirdhas*, for revenue purposes was, however, a different matter. They were the normal agency of the country, and, in spite of a general reputation for corruption and untrustworthiness, were capable of valuable work when better paid and closely supervised.

As time went on, increasing use was made of Indian draughtsmen, writers, interpreters, and collectors of statistical information. Thomas Munro, who carried through his revenue survey of the Ceded Districts between 1803 and 1808 with a staff that was almost completely Indian [II, 181–2], was a great champion of the employment of Indians in all branches of the services. Lord William Bentinck also realised that it was impossible to administer so vast a country without their aid. In a minute on the organization of surveys he writes in 1829 [195–6] ;

It is by a more enlarged employment of native agency that the business of Government will be at once more cheaply and efficiently transacted. It will be for the Surveyor General to suggest the means by which the instruction of the natives in this branch of science can be the most conveniently extended[1].

Surveyors themselves were strongly in favour of employing Indians wherever possible [161], and Norris writes from Nāgpur in 1828 ;

As several applications...made to Calcutta, ... Bombay, and Cawnpoor, for...qualified sub-assistants or draughtsmen have not been successful, the Superintendent will endeavour to instruct a few intelligent natives in the method of surveying with the plane-table, and their services will prove of the greatest use in exploring the wilds of...Bustar, etc., whose dreadful climate no European constitution could possibly sustain for any length of time[2].

In his proposals for the revenue survey of the Upper Provinces, Hodgson included for each district survey "4 ameens, or native measurers, at 25 rupees each", with a "moonshee, or...writer" [149] and, besides training "some of those docile people to be draftsmen and copiers of maps, hoped to make others into useful and cheap field surveyors " [306]. The term *amīn* was used only in Bengal, and in the Upper Provinces the local land-measurers were termed *mirdhas* and *mutsuddies*.

In native surveys I am not aware that the mirdhas ever do more than measure. Few of them...are able to read or write, and the calculations are made by mootsuddies[3].

On the re-start of the Gorakhpur survey in 1826, Hodgson asked for

a moonshee on 60 rupees per month, and four mootsudees on 10 rupees each, instead of 30 rupees allowed for one mootsuddee. ... 100 rupees was allowed for the above purpose when the survey was under Captain Grant. On Lieutenant Wroughton's return...his labours are perfected in a considerable degree by the assistance of the moonshee, whose local knowledge and good character entitle him to confidence, and I...hope that a good effect may arise

[1] BMC. 11–9–29. [2] DDn. 231 (134), 14–4–28. [3] from Holt Mackenzie, 17–11–27; BTC. 28–6–31 (34).

from this man being allowed to retain his former situation and respectability in the eyes of his neighbours. The Persian papers which accompany the maps were completed by him[1].

As the surveys advanced, it was found worth while to spend time and trouble in training the Indian measurers, whether for work under the professional surveyors or under the Collectors. Brown writes from Sahāranpur in 1827;

Much as Mr. Fraser has effected, a great deal remains to be done to render the mirdhas of real use to the State, and I beg leave to submit whether a school established for...teaching mirdhas would not be of great service [160–3]. A Surveyor with a sub-assistant and a senior apprentice might teach 20 pupils in six months to measure and calculate accurately. In the understanding that the mirdha was already a good accountant, the cleverest of them could be taught the use of the circumferentor and protracting their work, and present a possibility of...detecting errors, and thus, in a short time, the Collectors in the Upper Provinces would be supplied with good and efficient mirdhas, and they would be of much use to the Judge and Magistrate in deciding on cases of disputed property.

The interior surveys might then be dispensed with, and merely the boundary surveyed as at present, with the site of the village laid down, which would enable us to get over at least double the area we do now in the season[2].

Hodgson reported later that the experiment of the native survey school instituted by Mr. Fraser, and superintended by Lieutenant W. Brown, ... appears likely to answer, ... and probably...the natives of the Upper Provinces may be made very useful in the revenue surveys, for much subordinate assistance is required, and should never be denied, as it turns to great and profitable account[3].

Captain Bedford has also a native party which he has instructed, and which proves very useful, and he is organizing a second, and...I think he will survey faster than the Collector can settle. ... Much credit is due to Captain Bedford and Lieutenant Brown for their care in instructing the natives. ... I have directed the attention of other Surveyors to the subject[4].

Brown reports a visit from the Revenue Secretary[5] and his instructions to entertain six native youths for...teaching them surveying, which was accordingly done, and in a short time I succeeded in teaching them to write accounts in English figures, to keep field books in the usual form, and to survey with the circumferentor. ... In...April these instructions were put to a practical test by their surveying the interior of ten villages. ...

The salaries allowed the scholars...have been defrayed by Mr. Fraser up to the 1st May last. Seven more scholars have been added, and have been taught in the same manner, but I have instructed them more in the use of the bamboo jureeb [162], and common measurements of fields, which is most likely to be their practice in employment under Collectors, where there can be little doubt their services will be most useful, if properly looked after.

In 4 months after entertaining the six scholars, they were enabled to perform duty as surveyors of cultivation. In 6 months their field books and maps were examined by Major Oliver, and his favourable report was forwarded to the Surveyor General. Besides the six scholars on the establishment, I had 8 more under tuition at their own expence. ... 6 of them got appointments under the Collectors in the neighbourhood, and at Major Oliver's request I made over two to him, and they have since been with the Dehlee Survey[6].

Each drew Rs. 20 p.m. and, with a squad of three chainmen and three flagmen, "cost only one half what they would if headed by an apprentice", thus increasing "the efficiency of the survey" and reducing "the expense of superintendence"[7].

Arrangements were made later, writes Brown, to increase the number of Native Surveyors to 10. Last December I had the honor at an interview with His Lordship [Lord William Bentinck] to show one of their field books and a map executed by them. They are now capable of...all the field duty...—can observe with theodolites and other angular instruments, recording their work in English in a professional manner—can plot their surveys—and calculate area—and have executed the greatest part of my mapping. ...

The advantages derived to Government are...apparent—...opening a new field for...natives, teaching them a profession hitherto unknown to them in this Presidency—and allowing Government to take advantage of the cheapest agency—obtaining correct surveys of the land, on which the principle revenue of the State depends—and a properly authenticated survey, so necessary to the due administration of justice[8].

[1] BTC. 19–4–27 (41). [2] from Brown, 1–9–27; BTC. 19–6–28 (57). [3] from SG. 7–5–28; BTC. 19–6–28 (55). [4] ib. 18–9–28 (32). [5] Holt Mackenzie (1787–1876); BCS.; Writer 1807; Sec. to Terrl. Dept. from 1817; to England, 1831. [6] from Brown, 1–9–27 & 16–11–32; BTC. 19–6–28 (57) & 15–3–33 (26). [7] from DSG. 3–11–29; BTC. 8–12–29 (38). [8] from Brown, 16–11–32; BTC. 15–3–33 (26).

Bedford found no reference to his own efforts in Brown's report;

Captn. W. Brown apparently supposed that the benefits of native agency were first appreciated and introduced by himself. ... Many months before Captn. Brown's interview with Mr. Holt Mackenzie, I had not only instructed one or two native surveyors, but, so far back as June 1827, forwarded to the Surveyor General a specimen of work actually done. ...

In tracing the introduction of native surveyors into the Revenue Surveys, I have no desire to assume the smallest merit to myself. The fact is that, on my return from Assam in August 1826, I met a Mr. Mathews (since dead) at Gowhutty [146]. He showed me several small maps compiled from the work of a native surveyor, and spoke so highly of the accuracy, as well as the cheapness, of these operations, that on reaching Calcutta, I spoke to the Surveyor General about them.

He encouraged the idea and, when my survey was resumed in 1827, I took an early opportunity to instruct one of my party who seemed both able and willing. ... During the rains of 1827, he made a survey of Moradabad cantonments, and assisted in teaching one or two more of my party. By two of these men...nearly the whole interior details of the Suheswan survey have since been surveyed. ... Though very efficient as field surveyors they never learnt to plot or calculate areas, nor, indeed, until...there was no other way of reducing the expense, ... was I myself an advocate for employing these people except as field surveyors[1].

MADRAS

Both Mackenzie and Lambton were burdened with a tremendous amount of copying—professional records—routine reports—and statistical memoirs. This was entrusted mainly to the country-born assistant surveyors or specially recruited writers. It was not until 1828 that Montgomerie obtained sanction for every survey party to entertain a writer "for the purpose of preparing copies of memoirs, registers, statistical tables, etc.", and "with the view of preventing the subordinate surveyors from being employed on any other than their proper duties" [126, 393][2].

Reference has already been made to the Brahman and other interpreters employed by Mackenzie for his archaeological and historical researches, and one or more of these were attached to each field party collecting material for the statistical memoirs and verifying village names [II, 355–7 ; III, 101]. Some were discharged on pension in 1816, whilst about a dozen accompanied him to Calcutta to continue the work of deciphering and translating. Mackenzie could never have built up his famous collections without their assistance, and stressed his anxiety

to do justice to the industry and merits of persons who have been in a manner reared under my eye (some got about 20 years back) on a service of various and sometimes highly interesting nature, in the most distant parts of the country. ... It may not be improper in me to suggest measures suitable to their...pretensions to the countenance of Government[3].

Dunigan reports from Guntūr that,

Goomashta Anunda Raw [II, 155], having completed the...village accounts in the Innakonda District, I have directed him to assist Venket Row in finishing with all expedition the accounts requisite...in the S.E. quarter. ... I shall then require their assistance here in aiding me in the description of the villages, and...the compilation of the memoir[4].

Anand Rao accompanied Dunigan to Masulipatam, and continued with the Circārs party till the end of 1825, when he was dismissed for misconduct[5]. For his statistical memoirs of Travancore, Ward was assisted by

the Bramin Nital Nirrah, and also by the hircarrah, who were also employed in the collection of materials for a general history of the country, but nothing in a definite shape. A large portion of these materials has been monthly communicated to Colonel Mackenzie by the Bramin, and the remainder, containing two parcels under his own seal, one of Cadjan books, the other of papers, will be delivered in the office by Captain Conner on his arrival [109][6].

This Nital Nirrah had been recruited in 1803, and was only drawing Rs. 35 p.m. with the Malabar survey when he died in 1827 at Cannanore[7].

[1] from Bedford, 26–3–33 ; BTC. 13–5–33 (51). [2] DDn. 222 (341), 184 (486) ; 21–& 24–10–28. [3] from SG., 1–8–16 ; MPC. 440/1816, 28–9–16. [4] DDn. 148 (124), 6–6–19. [5] MMC. 636/1817, (6545–9). [6] DDn. 192 (26), 30–12–20. [7] DDn. 237 (160).

The following interpreters were on the headquarter roll in June 1817[1] [II, 355–6];

C. V. Lechmya [Lakshmaiah]	...	Brahman	Head Interpreter ; Tellinga & Sanscrit translator.
Abdul Azoor	...	—	Persian Moonshee
C. V. Ramaswamy	...	—	Pundit.
Durmiah Poorooshotamiah	...	"the old Jain" [II, pl. 22n.]	Canara Writer & Interpreter.
Venkat Rao ...	...	Brahman	Modern Canara Writer & Interpreter.
Venkat Sooliah ...	...	,,	Tellinga Writer & Interpreter.
The above are all in the office at Madras.			
Baboo Row ...	...	Brahmin	Mahratta writer & Interpreter ; detached to the southward.
Narrain Row ...	...	,,	Tamul & Canara Writer & Interpreter ; in the Nizam's Country.
Ram Doss ...	...	,,	Tamul & Canara ; detached in the Northern Circars [d. Calcutta, 1821].
Appavoo ...	...	,,	Tamul ; detached in the Arcot Province.
Gundapah ...	...	,,	High Tamul ,, ,, ,,

Lechmya and others selected for Bengal left Madras in December 1817, and marched up the east coast [311]. They were not happy in Calcutta, and several, particularly Lechmya, had family troubles and litigation in Madras [II, 356]. For others or their families Mackenzie succeeded in getting pensions.

It was my part to...compensate the...people who were constantly about me for many years. ... The principal of them was the Bramin Lechmyah, who actually formed the rest to my pursuits. ... He never deceived me as to money matters ; ... he acted the part of a careful servant, ... &...that he was even neglectful of his own interests from his attention to mine was well known to me. ... He was poor and embarrassed & I believe honest. ...

The brother Ramaswamy[2] that is with you served me long without any pay, & afterwards on very small pay. The 25 pags. lately allowed him as Interpreter Saastree &, was a compensation for many ingenious explanations he procured me. ...

A Sanscrit-Tellinga & Canara interpreter will be always necessary...on account of the orthographical correction of names, or proper spelling of places[3].

Riddell wrote that

Ramaswamy has got a situation at the College. It is one of the best there, but, being only 15 pagodas per month, he is to draw the difference between it and his former pay (i.e., 19 pagodas per mensem) from the Survey Department. I pay old Dhurmiah and Kistnajee [the peon] their allowances regularly [316, 318, 392, 396][4].

The archaeological work on which these interpreters were employed was entirely extraneous to the official duties of the Surveyor General[5], and after Mackenzie's death those at Calcutta were discharged, as Hodgson did not think them

necessary in the Surveyor General's Office, as they cannot, in my opinion, contribute any aid to the extension of geographical knowledge, the object for which this office is constituted. ...

I enclose a list of the names, ... with the designations under which they serve, and the salaries paid to them, and...suggest that they might, perhaps, be employed in the College[6], or some other Department. ... The Department may be relieved from the charge, and...the families of such...as have died may be provided for. ...

There is also a Javanese writer who was brought round from the Island of Java in 1813 by the late Surveyor General [II, 427], and his salary of 70 sonat rupees was sanctioned by Government on 11th November 1817. As this person is himself desirous of returning to his own country, ... Government may be pleased to direct a passage to be furnished...to Java[7].

Special consideration was given to "Cavelly Venkata Lutchmiah" who, with his brothers, had served Mackenzie with the utmost devotion from 1796 [II, 355–7];

In the year 1809 a promise was made...by the Government of Madras of a pension equal to three fourths of the salary...then received. ... The late Colonel Mackenzie, according to your statement, promised to obtain for you the grant of a retiring pension amounting to... your actual increased salary, on condition of your accompanying him to Bengal, and bringing round the establishment which Colonel Mackenzie had formed under your direction for... researches into the history and antiquities of Southern India.

[1] MMC. 636/1817 (6545–9). [2] presumably Venkata Ramaswami, auth. of "*Biographical Sketches of Deccan Poets*", pub. Calcutta, 1829. [3] to Riddell ; DDn. 156 (337), 17–4–18. [4] DDn. 151 (130, 139), 9 & 18–2–18. [5] though approved by the Directors [II, 111]. [6] Ft. William College [II, 308], or that at Madras. [7] DDn. 196 (22–4), 6–6–21.

You have produced no written proof of the above engagement on the part of Colonel Mackenzie, but as it is known that Colonel Mackenzie entertained a high opinion of your merits and services, and as other members of the establishment...were encouraged to expect pensions equal to *half* of their allowances, or the like allowances to their families if they should die in the service, the Most Noble the Governor General in Council is disposed to view favourably your application to receive a pension equal to your present allowances. ...

On your returning to the Coast, the Government of Fort St. George will...order the payment of the pension of the three hundred rupees at such places as you may choose for your residence. ... You should continue to render your assistance in arranging and describing the materials...for...being transmitted to the Hon'ble the Court of Directors. ...

With regard to the marks of distinction...you solicit, ... the Governor in Council of Fort St. George will be solicited to bestow upon you such marks of consideration as...[they] may think proper. ... The...conversion of your actual tenure of the village of Tinnanore into a rent-free tenure...will be recommended to...the Honourable the Court of Directors. ... The Governor General in Council cannot directly interpose for...the restitution of your paternal village in Masulipatam, from which you state yourself to have been unjustly ejected [II, 356][1].

Lechmya loyally stayed on in Calcutta for the next two years to assist Horace Wilson [312] in cataloguing the manuscripts which he took over from the Surveyor General. Later, in 1830, he persuaded the Government of Madras to transfer that part of the collection that was held by the Madras College to the Madras Literary Society, where it could be properly arranged. On his further pressure in 1836, a distinguished scholar was deputed to complete the task[2].

Though it is generally held that the three Madrasi figures supporting Mackenzie in Thomas Hickey's notable portrait of 1816 are definite likenesses of Lechmya, of the Jain Dhurmiah, and the peon Kistnaji, their respective indentities are by no means clear, and are discussed elsewhere [II, pl. 22 n.].

BOMBAY

During the Marātha war Dickinson had to give up all his military surveyors except Tate, and when Tate took over in 1821, his establishment on the Bombay and Salsette revenue survey was wholly Indian—

natives whom I have lately instructed in...drawing and surveying—and...the extent of their abilities and practical knowledge must ever confine their duties to the more mechanical branches. ... It...becomes my duty constantly to superintend and be a check over their work, so that, in case of any indisposition or casualty befalling me, their operations...must cease for that time. ... The four native draughtsmen were added...on the 27th July 1818, and the four native surveyors, and one mattara, on the 1st February 1820.

Though the deficiency occasioned by the removal of the Engineer Assistant...was to a certain extent supplied by the addition of draughtsmen and surveyors to the native branch, ... they came...perfectly unacquainted with any of the duties they were expected to perform. ... It became...necessary to instruct them in the first rudiments. ... It was not till October last, at the opening of the fair season, that the survey derived any benefit from...the native surveyors, but the draughtsmen had afforded considerable assistance...a twelve month or so before. ... It was not in my power to devote much of my time to the...more mechanical operations of the survey, but I was then...enabled to avail myself...of the native surveyors.

I...bring forward...the exertion and merit already displayed by some of the native surveyors and draughtsmen...as deserving of...encouragement, and...to recommend certain gradations of salaries...according to their relative merits ; which measure would...excite a strong emulation, and thereby...expedite the surveys. ... I...suggest an increase of native surveyors, which will always admit of two complete sets...being employed on each island[3].

After his retirement Tate sent Jervis a fuller account of these surveyors ;

The natives of India, ... if properly instructed and disciplined, ... might be brought to such ...skill in the various branches of surveying, even from the capacity of a chain measurer to that of an accurate observer with the theodolite, as well as of a neat draughtsman, as very considerably to abridge the personal labour and fatigue of European Officers, especially in

[1] BGC. 17-8-21 ; DDn. 191 (313-7). [2] Higginbotham (pref. 12). [3] from Tate, 31-8-21 ; Bo RC. 5/1821 (453-77).

such a climate as that of India, which...is such as to render great exertion in the out-of-doors duties of the Surveyor most prejudicial to the European constitution. ...

At one period Government appointed two infantry officers as my assistants, viz., one for Bombay and one for Salsette, but I had all the trouble of instructing them in surveying and drawing. ... I was well pleased when Government required their services for regimental duties, and I was permitted to employ...*any number of natives* I required. ...

By the assistance of several parties of surveyors the work was extended, ... and the two surveys were then brought *rapidly* to a close, ... and the first plans drawn...by *separate draughtsmen*, who had not been instructed in surveying. ...

Had such a system been adopted some years previously, my own health and constitution might have been preserved to this day, ... and the two surveys of Bombay and Salsette might have been completed in half the time, and perhaps at one fourth of the expence. ... The labour of out-of-doors work is certainly much more calculated for natives than for European and, as for the mechanical part of the plan drawing, ... I will be bound to say that my native draughtsmen would compete with most Europeans in India.

My knowledge of them leads me to say—Instruct them well—Show them kindness, as well as firmness and consistency. ... They require but comparatively low salaries, for their wants are comparatively little. I have found them obedient, submissive, and faithful servants, and should you ever fall in with any of my poor surveyors and draughtsmen, pray enlist them, if disengaged, into your service. The letters I have received from them prove their affection for me, and that they are not unmindful of my labours in their instruction[1].

Jervis, also, on his survey of South Konkan [126], had a staff almost entirely Indian. From March 1823 he was allowed a draughtsman on Rs. 100[2] and a writer on Rs. 80 p.m., and by 1826 he had collected six Indian sub-assistant surveyors,

whom I have instructed...for two years past at a considerable private expense, with a view to some future relief from the more laborious and simple details of the survey. Four of them are Brahmins, and two Portuguese, and I request that I may...draw from the 1st of the ensuing month 30 rupees monthly for each surveyor, to carry their instruments and assist them in surveying ; who, with the addition of the surveyors hereafter to be furnished from the Engineer Institution [*inf.*], will enable me to conduct the detail survey both expeditiously, correctly, and at little greater expense than if a single officers were attached[3].

Two of these surveyors, Hyum Essajie and Vishmu Agashe afterwards worked for the Chief Engineer, the Quarter Master General, and with Henry Giberne.

On the Deccan survey, also, Jopp had a draughtsman on Rs. 100 p.m., and he later got authority to engage others for the Deputy Surveyor General's office ;

The officers of the Survey Department in the Dukhun being employed on the preparation of a map of that country on a large scale, a work which can scarcely be completed in less than 4 to 5 years, during which the field operations...must be suspended, I...suggest that that duty might be performed in this office equally well, and certainly at a much less expense, ... by good draughtsmen entertained for that purpose, leaving the officers to be more profitably employed...on actual survey [126]. ... If sufficient number are not immediately to be found, others well qualified might from time to time be supplied from the Institution under Capt. [Geo.] Jervis [384][4].

Shortrede's writers included a *purvoe* and a *karkun*[5], but he could not find suitable Indian assistants for technical duties ;

On the 1st January 1830 my office establishment consisted of a purvee Modhan Kas and a karkoon Dajy Govind, both natives, each receiving Rs. (30) thirty a month. Their duties and qualifications differ in no respect from those required for similar situations in other Departments. ... The pay of purvee is rather too small in relation to that commonly received, ... because when perfectly qualified to perform the work of my office, he is able to get better pay elsewhere, and on this account the above-mentioned purvee has since left me.

I have not...to been able to find persons—properly qualified by their mathematical and mechanical knowledge—steadiness—willingness to work with ability, to endure fatigue and exposure—to perform the duties...as draftsmen and assistants, and apprentices. They would have...to use various mathematical instruments, with whose construction and adjustments they ought to be acquainted, as also with the calculations ordinarily occurring in the survey[6] [389].

[1] from Tate, 12-9-38; Thomas Jervis (Appx. 1) ; Jervis (209). [2] probably Forjett, employed by Jopp 1830-2 ; DDn. 235 (35), 29-6-32. [3] from Jervis, 28-2-26 ; Bo MC. 5/1826 ; nominal roll, DDn. 234 (14-6). [4] from Jopp, 20-2-26 ; Bo MC. (camp), 6/1825-6 (657-8). [5] clerks or writers, *Hobson-Jobson*. [6] DDn. 323 (220), 19-11-30.

LASCARS & FOLLOWERS ; BENGAL

Under the normal rules for surveyors' allowances, every Surveyor drawing full allowances had to pay for his establishment himself, the salaries of 1777 and 1785 having made generous provision for followers at the rates then prevalent [I, 276–7, 289]. The rules of 1817 for the officers on the Quartermaster General's staff [334–7], provided that their reduced permanent salary should not cover the pay of followers, which was to be charged in contingent bills. Each surveyor was to justify the rate of pay and the number of followers employed. In supporting claims made by Jackson [348], the Quartermaster General found that he

has explained to the satisfaction of the Commander-in-Chief that he necessarily maintained two bangee burdars [269] on monthly pay for the carriage of his instruments, and three khalasies to carry, plant, and shift his flags, and run his perambulators. The same want must have been felt...by the other officers, ... and is stated on so moderate a scale, that His Lordship can have no hesitation in recommending the admission of these...charges[1].

Two years later, Jackson's charges during his halt at Nāgpur [27–8] were challenged in audit, and he explained that his men had been entertained

in Calcutta, and could not in justice have been discharged at Nagpoor, a distant of 740 miles, and left to find their way back, ... particularly when the unsettled state of the country...is taken into consideration ; besides my having...every reason to suppose their services would be required in the performance of my survey duties. ... On my becoming acquainted with the natives of that part of India, the necessity for retaining these men became more decidedly obvious for, could I have procured others (which was utterly impossible for me to do), they must have been paid the enhanced rates of wages...and would have been totally useless from the want of competent knowledge of the Hindoostanee Ooriah, and Bengally languages[2].

In Bundelkhand [81] Franklin employed ;

1 Moonshee		Rs. 15	Indispensably necessary for...a regular intercourse with the native chiefs, and for...information of roads, limits, and lists of villages.
1 Jemadar		Rs. 8	Well trained, and absolutely necessary for...conducting the advanced flag of the trigonometrical series.
2 Clashies	@ 6	Rs. 12	Trained for...striking upon signal, and bringing in the near flags when required.
4 Coolies	@ 4	Rs. 16	for carrying bamboos of the flags and spare flags.
4 Coolies	@ 4	Rs. 16	for the carriage of Maps & Instruments.
1 Coolie		Rs. 4	for the carriage of the Theodolite.
For Flags, Bamboos, Camp-line and Rope for splicing bamboos.			The Flags were 6 feet by 7 feet. The Bamboos 30 feet and upwards in 4 length ; the Camp-line was made of cotton, and Rope in daily expenditure[3].

For revenue survey parties in the Upper Provinces, Bedford found

that the field work can be carried on very well with the number already kept up, viz., 1 smart head man, or tindal, and 10 others of all descriptions.

To guard against sickness, however, ... one or two more should be entertained, and a good effect might also be produced by establishing two ranks of lascars, and two rates of pay, the higher...for a certain number who may evince superior intelligence and activity. These rates would be very moderate at 6–8 and 5–8 per mensem, considering that the labours...are heavier than those generally experienced, ... since, in addition to about six hours work every morning, many...are required...to examine and report on boundaries—clean the instruments—ascertain the situation of jheels, junguls, and wastes to be surveyed—and other similar duties. ...

Hircarrahs...appear...perfectly unnecessary if...a proportion of the police and revenue chuprassees accompany...for...procuring the attendance of the zemindars whenever necessary[4].

Each party was then allowed a fixed establishment of—1 Tindal, Rs. 11–8–0 — 5 Lascars @ 6–8, Rs. 32–8–0 — 6 Lascars @ 5–8, Rs. 33–0–0 — 1 Bildar Rs. 4–8–0 — in addition to contingent charges to cover "cost, carriage, and repairs of the office tent, the wages of a common tent lascar, and a sweeper"[5].

When Simmonds joined the Delhi party, he obtained special sanction for a squad for survey of villages boundaries, viz.,—

[1] DDn. 141 (295), 25 & 27–6–17. [2] DDn. 196 (44), 9–6–21. [3] DDn. 69 (7), 30–1–20. [4] from Bedford, 22–7–22 ; BTC. 19–12–22 (22). [5] ib. 19–9–22 (53–5).

for the Chain, 4 Lascars—for the Offset Chain, 2 Lascars—for the Flags, 6 Lascars—for digging station marks, and clearing rough ground, 1 Bildar—for carrying instruments, etc., we use our own private servants[1].

When Grant sailed for Burma in 1825 he took no porters for his precious astronomical instruments [183];

Though I engaged a set of bearers, ... I cannot persuade them to leave Calcutta before the end of the month. Such a delay, however, would probably lose me my passage, ... and I am therefore...proceeding without them. I trust...I shall be able to obtain at Rangoon such assistance as may be required. ... It is natural I should feel considerable anxiety, ... considering the heavy expense of the instruments...and the pains I have taken in rendering them portable. It would...be a very great disappointment to me if, after all this trouble, want of carriage alone should deprive me of them.

The lower circle and the supports of the vertical circle require 4 carriers, the vertical circle two, the two transit instruments two each, the reflecting circle, chain, barometers, and chronometers, two more, making a total of twelve[2].

He could raise no men in Rangoon, and had to appeal to the Surveyor General in Calcutta. Jackson, the D.Q.M.G., regretted

exceedingly that you quitted Calcutta without bearers, for I doubt much your getting them at all, and if you do get them they will be a set of good-for-nothing fellows. I have written to Colonel Stevenson [Q.M.G., Bengal] very strongly on the subject, and urged everything I could for them and clashies, being the very best to be got[3].

Government orders were necessary before men could be despatched from Calcutta.

Blacker found it impossible to run his Calcutta office on Rs. 44 a month, the allowance fixed in 1788, and had the strength raised in 1824 to

1 Artist [313]	@ Sicca Rs.	25	1 Chokedar	Sicca Rs.	6
1 Daftry & Mate	,,	12	1 Durwan	,,	5
1 Jemadar	,,	10	1 Sweeper	,,	5
3 Hircarrahs	@ 6 each ,,	18	1 Bheestie	,,	5
2 Lascars	,, ,,	12			

Total Sicca Rupees per mensem Rs. 98, or Sonat Rs. 102-3[4].

MADRAS & BOMBAY

Though Madras surveyors also had to meet the pay of their own followers from their allowances, they were allowed to charge separately for those of their assistants, the numbers being laid down by regulation. Two were allowed to each assistant, but three in Travancore, whilst a later order allowed four to the assistant surveyor on the Hyderābād survey[5]. Strict rules[6] limited the period for which these lascars might be charged [350-1];

On individuals...being ordered from the field to the Presidency, pay for lascars shall cease from the date of their quitting the survey, ... unless in charge of instruments, when such number as may be considered necessary...shall be retained on the same allowances. But lascars and coolies discharged at a distance will receive an allowance at the rate of 3 annas for every 20 miles to enable them to return to the places at which they may have been entertained. ... During the suspension of field operations...for inclemency of weather, batta for lascars shall not be drawn, and the officers...actually in charge will certify the arrival and departure of parties at...head quarters during such suspension. Officers in charge...will take every opportunity of ascertaining that the...lascars authorized for sub-assistant surveyors are kept up in an efficient state.

In the event of the charge...devolving on the senior sub-assistant, ... he shall be allowed to entertain three lascars in addition to the number authorized by the regulations, for the...protection of instruments for which he becomes responsible[7].

Both Mackenzie and Lambton regarded their followers as private servants, members of their households. When he left Madras Mackenzie was much distressed at having to leave so many behind [318];

[1] BTC. 30-4-4 (100-1). [2] to QMG., Calcutta; DDn. 216 (7), June 1825. [3] ib. (34), 4-8-25. [4] DDn. 204 (75), 14-7-24. [5] DDn. 192 (128), 12-5-21; & 184 (343), 1-10-23. [6] bearing a distinct family likeness to the rules of 100 years later. [7] DDn. 218 (186), 9-2-30.

My immediate servants, my dependents of 20 years under every privation, in every situation of difficulty, distress, even danger; from Hyderabad & Seringapatam, to the unhealthy climate of Batavia, for years I had encouraged their perseverence & zeal. ... You will recollect the trouble even risk under which I left your detachment in 1792 to get a sight of Gooty & rejoin you on the march to Gandicotta[1], ... & now these useful people, or such of them as survive, are likely to be thrown out of all employment. The poor provision of a pension, after all their labours, ... is still undetermined[2].

He was particularly anxious that special consideration should be shown to his personal orderly; "that useful man Kistnajee should be employed in the office as conicoply [I, 290], to assist the care of the instruments" [II, pl. 22 n.].

Dickinson took with him on military survey in North Konkan [128]

a Purvoe [393], Peon, and six Lascars, which proved very insufficient. the whole of whom are now laid up with the jungle fever, without a prospect of their being for some time fit for active duty in the interior. ... I have...to request that arrears of batta at the rate of 5 pice a day for each lascar and peon may be sanctioned for the very severe duties I have been obliged to exact of the people[3].

Surveyors in the Deccan employed 4 lascars each @ Rs. 10, whilst Jervis in the Konkan had 5 coolies @ Rs. 8 each. Shortrede had 10 lascars @ Rs. 9½ per month, 3 *jasuds*[4], and 2 peons @ Rs. 7.

The duties of the lascars are to carry the instruments. ... Those of the jasoods and peons to put up station piles on such hills as I may find necessary, ... and to keep up communication with the Deputy Surveyor General. ... I find their number to be only sufficient for the discharge on the ordinary duties of the survey. The jasoods and peons are required to be rather more intelligent than the generality of such people, as they must occasionally be entrusted with a discretionary power in selecting stations in unknown parts of the country.

The pay of the whole department was at first purposely made on as low a scale as possible in order that no one might consider himself above hard work[5].

GREAT TRIGONOMETRICAL SURVEY

When Everest first joined the Great Trigonometrical Survey he was greatly impressed with the patriarchal manner in which Lambton ruled his large following—three sub-assistants—escort about 30 strong—bearers for the great instruments and tents, from forty to fifty—flag coolies and post runners, at least thirty—with families as well [399, 403]. Further coolies were charged on contingent bills;

Although I have a very large permanent establishment, yet, from sickness, and from the numerous little articles of comfort which I must take along with me, I am always obliged to have a number of these coolies, and my followers, who have been for many years with me, having most of them their families, I must indulge in this particular, taking care, however, that every person who attends my camp is paid for his labour[6].

Everest tells of the devotion and success with which the flagmen went out in twos or threes into the desolate fever-ridden forests, and how loyally they persisted in spite of sickness and difficulties [230];

I learnt how to value the natives of southern India, who, knowing no master but the Lieutenant Colonel, unconnected with and unknown by the Government they served, without provision for themselves in case of their being crippled by sickness, accident, or age, or for their families in the event of their death, yet ventured fearlessly and without a murmur to face those awful dangers which would have made the stoutest hearts quail and shrink.

The personal exposure which soldiers cheerfully submit to in the day of battle is cheered by the reflection that, dying, they do not die alone or ingloriously; but there is a forlorn and desolate feeling produced by the thought of yielding up one's life in a wilderness, with none but jackals to sing our requiem, and tigers to prowl, and vultures to flit, round our tombless corpses, which harrows up the soul with inexpressible horror[7].

On Lambton's death, many of these Madrasi followers were loth to continue service; his death "had naturally created a sort of desponding feeling amongst his

[1] presumably when attached to the Ellore Detachment [I, 112]. [2] to Josiah Marshall, DDn. 156 (67), June 1816. [3] Bo MC. 309/1817 (6373–83), 19–11–17. [4] *jasud*=messenger. [5] DDn. 323 (25), 21–5–30. [6] DDn. 63 (426) & 92 (8), 27–11–17. [7] Geo. Everest (15).

followers, of whom many had been with him from the very outset of his career, or born in his camp". Still Everest was able to report to Madras that,

although this survey has been transferred to the Presidency of Bengal, a very considerable part of the old establishment remains with it. The families of most of these reside in the territories subject to our Government, and it is their anxious wish to have some convenient mode of remitting the saving of their pay. ... It is so much of consequence to me that my people should be comfortable and contented, that I shall feel myself very much indebted to you if you will authorize such arrangement[1].

For those who decided to quit, replacements were found from Upper India ;

People have been brought by me from Hindoostan...at vast expence on my part, to supply the place of my Carnatic followers, most of whom object to being employed north of the Godavery. The people in question have for the last 3½ months been in training, but they refuse to be employed to the southward of the Dhabba Ghat[2], and if the course of my operations be now diverted, I shall, after having incurred this heavy expense, be for a time totally without people to carry instruments and flags, unless I trust them to untrained persons, or such common coolies as chance may throw in my way.

As the instruments are of immense value, ... it is necessary to select the persons who manage them with great care, because the task is one of great skill and nicety. ... I am obliged to pay them very high wages, and to treat them with a degree of indulgence not generally shewn to native followers[3].

There were occasional lapses from good conduct, and Everest had sometimes to call in the aid of the civil authorities ;

My Dear Low [245], I have a very disagreeable business to refer to you. One of my people is accused of having seized a Goandee girl, and ravished her, and the injured parties have come to complain to me ; but, as I know not how to adjust it, I have sent the offender under a guard, and have desired the complainants to lay their cause before you.

The offender, by name Rama Swamee, was some time ago in a state of lunacy, and I had him for many months in strict confinement to prevent his doing mischief. ... He seemed to be restored to his senses, and the old man with red breeches, ... who is head man of all my Carnatic followers (Ramaswamee also by name), earnestly entreated me to release him, and engaged to be responsible for any future offence he might commit.

These people all speak Teloogoo, but to assist you I have sent one of the naiks of my escort, Asud Khan, who not only speaks Telloogoo, but Hindoostanee pleasantly[4].

When handing over to Olliver in 1825, Everest left a reduced establishment ;

The present establishment provides for the carriage of the zenith sector, the large theodolite, and the clock, neither of which will now be required ; the expense therefore may be considerably reduced, but...the rates of wages actually paid...are somewhat higher than those hitherto sanctioned. ... For instance, the rate for each cooly now allowed is 6½ Sa. Rs., whereas the instrument coolies receive Rs. 7–2 each, and the principal flag coolies nearly Rs. 8 ; moreover, without spare coolies there is no method of conveying messages from one station to another, so that some hurkarrahs will be quite indispensable. The following...will be required to keep the establishment efficient ; ...

Instrument ...	... 4 Coolies	Small Theodolite	... 1 Cooly
Circle ...	... 2 „	2 Barometers	... 2 Coolies
Stand ...	... 1 Cooly	Chronometers	... 1 Cooly
Tent ...	... 4 Coolies	Lanterns, box	... 1 „

Total	16 coolies	@ 7–2	Rupees	114–0–0
	1 Sirdar of Coolies	...	„	20–0–0
	12 Principal Flag Coolies	@ Rs. 8	„	96–0–0
	12 Flag Coolies	@ Rs. 7–2	„	85–8–0
	6 Hurkarrahs	@ Rs. 5	„	30–0–0
	4 private tents	@ Rs. 22	„	88–0–0
		Total Sa. Rs.	...	433–8–0[5]

This involved the discharge of several of Lambton's men and, writes Olliver,

The mode hitherto adopted by the late Superintendent, in the case of discharging any part of the carriers, was to make over to them one month's pay, exclusive of a full month's pay for any number of days of the month of their discharge. This was considered in all cases sufficient to enable them to reach their homes. ...

[1] DDn. 172 (119–20), 9–2–24. [2] Dabaghaut, on hill crest NE. of Ellichpur [pl. 17]. [3] DDn. 171 (168), 17–3–24. [4] DDn. 172 (141–2), April 1824. [5] DDn. 171 (412), 20–9–25.

The party entertained by Capt. Everest...were all anxiously looking homewards so soon as they lost their old master and benefactor, and were one and all averse to the idea of continuing longer with a department penetrating further north, and working up to Hindostan, for every move would take them further from their native country.

Captain Everest was fully well convinced of the Carnatics being the best sort of people adapted to such labour, ... from...the fatigue and hardships they cheerfully undergo and, as the establishment could not move without them, it then fell to me to explain to the whole party...that they should continue to meet with every indulgence as before, if they would consent to remain till three years expired, or till the work was completed up to Agra, and after that it should be optional to them to continue or to return to their homes[1].

In 1830 Government asked whether it was not possible, now that the Great Trigonometrical Survey was working entirely within Bengal, to reduce the number of men and bring their pay into line with local rates. Walpole replied that the number could not well be reduced, but suggested a lower scale of pay ;

The monthly pay of Lascars under the Madras Presidency, while in the field, is 9 rupees 13 annas[2], which is much higher than that of the principal lascars of the Trigonometrical Survey. The Military Auditor General informs me that the ordinary pay of lascars under this Presidency is 5 rupees, and coolies 4, which is lower than what the corresponding classes receive in the revenue and military surveys.

The lascars and coolies of the Trigonometrical Survey have more labourious duties to perform than those of other surveys. They must be active, steady, and intelligent, and are therefore entitled to higher pay than men who are merely required to wheel a perambulator, or carry a measuring chain. A reduction might, however, be made in the present pay, ... and I have noted...the rates which...might be granted in future—Principal Flag Lascars, Rs. 7–8–0—Secondary, 6–8–0—Instrument Carriers, 5–8–0[3] per mensem.

This reduction roused Everest's fury when he rejoined shortly after, and in the following protest he gives a good description of the work of a lascar of the Great Trigonometrical Survey—

It is a wild, rough, kind of life, but it is difficult to conceive a duty more harassing, or calling for greater perseverance and intelligence, than that entrusted to the men who...occupy stations in advance [230]. ...

When the height...is one of a mass which fills a large portion of the horizon, ... it becomes a most serious task to discover the identical eminence which has been pointed out from a station distant 30 to 60 miles in a straight line. ... The object is only ultimately attained by ascending a succession every peak likely to be that pointed out, ... and then mounting the highest trees. ... This operation has often to be gone through in a country covered with large forest trees, all of which must be felled, and abounding with wild animals ; where provisions are scarce, where there are no bazars, and no water but what falls from the clouds. It will cease to be a matter for marvel that I should rate so highly the value and importance of the people who have to effect it.

The people detached on these occasions often disappear for weeks for to surmount a straight distance of 40 miles in mountain lands it is not unfrequently necessary to travel full 80. They must wait too for clear weather, otherwise after all their trouble they may fail in finding out the right eminence [244]. ...

I have seen natives of the Coast, belonging to the old establishment, who were hardly ever at fault in the most trying circumstances. To keep these people together when, after the death of Colonel Lambton, they had to quit the southern provinces, ... was no easy matter. I did my best to do so, and succeeded to a certain extent, so that the establishment with which Mr. Olliver commenced the Longitudinal Series when I went to England was, though not so efficient as could be desired, yet not entirely shorn of its ablest flag-men.

The arrangement made in Major Walpole' letter of 16th August 1830, by reducing their pay, instead of increasing it and holding out prospects of future reward, as I should have recommended, tended mainly to destroy the principle of cohesion. ... Applications are daily made by the few who remain for leave to return to their homes, and if decisive measures be not taken it will be totally impossible, in my opinion, to revive the drooping spirits of these poor people, or again put the establishment...in an effective state.

The question naturally arises, how did Colonel Lambton effect this, and the answer is plainly he had a surplus proportion of people, and had thus funds at his disposal for giving high pay, and occasional presents, to those who proved themselves trustworthy[4]. His establish-

[1] DDn. 173 (5), 12–12–25. [2] including *batta*. [3] DDn. 265 (41–3), 16–8–30. [4] In early days it was usual to draw full salaries for authorized ests. regardless of number present [II, 348 ; III, 312–3].

ment cost, too, more than he received. A system of this sort may be perpetuated much more easily than created. His people were in the outset encouraged to bring their families with them, so that they formed a little colony of their own, and many of the younger lads of the establishment had been born in his camp. ...

The difficulties of moving...were less than at present, because the practice had not then been abolished...of taking village coolies ; not that I...advocate the practice, I speak of it merely as a fact [411]. ... All things in India are undergoing a change, and the ideas of the inhabitants are gradually altering ever since I can recollect. It must needs be so in peaceable times of long duration, such as this country had not known before this out of mind [t–page].

Even in Colonel Lambton's lifetime, however, the older and abler hands began gradually to fall off, and the serious disasters east of Hyderabad [231–2] had so thinned their ranks that they formed but a wreck of what they had once been. But with any establishment constituted as it was prior to my return to England, the difficulties were enormous, and the...expedients which I was obliged to resort to, the extra duty to which my people were exposed, are such as never can, or ought, to be expected from men except in cases of emergency. ...

It frequently occurs that nine principal stations are in occupation at the same instant. A flag staff 22 feet long is erected at each during the day time, and a light burning at night. The flag staff must be kept truly perpendicular during the day, and these stations are perhaps distant 30, 40, or 50 miles from the ninth where the instrument stands. I mean...distances as the crow flies, but in truth in mountainous tracts they are about double the distance, so that to communicate with them 3, and often 6, days are necessary.

The people then are in manner left entirely to themselves, and if they have no motive to incite them to exertion, they will infallibly go quietly to sleep in the best quarters they can obtain, in preference to sitting all night long on the top of a cold mountain, with naught but rocks and fallen trees scattered around them, and tigers and bears to break in on the general desolation and solitude.

In certain cases it is necessary to supercede the ordinary lights by blue lights ; the best blue lights will burn 6 minutes, and then expire, and as they are costly both in make and in the carriage, it is necessary to be economical of them. To burn 18 blue lights requires nearly 4½ hours, and if they are not well timed the observations cannot be made, and must be repeated [247–8]. It has hitherto always been necessary to employ one of the sub-assistants with a watch for this purpose, in which case he has to travel from one station to another. The loss of time...consequent on one failure is enormous[1].

Officers of the Survey of India will endorse all that Everest has written of the devotion and loyalty of survey *khalāsis*, whether of the Trigonometrical, Topographical, or Revenue branches, and whether they be men of Madras, Hazāribāgh, Garhwāl, or Punjab.

[1] DDn. 283 (125), 10-8-32 ; BMC. 29-10-32 (70).

CHAPTER XXVIII

PEOPLE & COUNTRY OF INDIA

CARE OF HEALTH; South India—Great Trigonometrical Survey—GUARDS & ESCORTS—SURVEYORS & THE PEOPLE; General — Great Trigonometrical Survey — Commissariat Agent — Nizām's Territories — POSTS & COMMUNICATIONS.

If we do not here refer specifically to the surveyors of Bengal and Bombay, this is not because they were any less prone to fever, dysentery, and other diseases of the east, than the surveyors of Madras [II, 359–63]. Far from it. We have told elsewhere of the interruptions to their surveys by sickness; Smyth in Chota Nāgpur [II, 46] Hodgson in Sirmūr [35]—Gerard at Agra [90]—Wilcox in Assam [64]—Grant in Tenasserim [77]—and many others.

None knew of the crippling effect of ill-health better than Mackenzie, and when organizing his field parties in 1815 he made particular reference to the need for regular medical attendance, both for parties in the field as well as for assistants at the Presidency, many of whom came in from the districts in a wretched state;

The termination of some of the surveys, and the necessity of relieving the sick...from unhealthy situations by removal to the Coast, has occasioned that about 11 of the native assistant surveyors are here at present, all employed in office excepting those who are in a state of convalescence, and that cannot attend regularly. ... Medical assistance should be afforded in this case for their relief[1].

The Medical Board replied that those at the Presidency would be attended by the Garrison Surgeon, and that with regard to those at

out-stations and in the field, the Medical Board feel considerable difficulty in deciding upon any particular officer. ... The same sense of public duty which urged Messrs. S. and A. to afford the ready and willing assistance adverted to by the Surveyor General will...prompt every medical officer...to afford similar aid when...necessary[2].

Dindigul was found particularly unhealthy during season 1815–6 [110];

Progress...in the quarter ending 31st January was slow in consequence of the repeated interruptions from sickness and the monsoon. It was commenced in 1813 under the hopes of being terminated at a much earlier period. About the middle of October last the surveyors were obliged to come into Dindigul, where they were employed in protracting and reducing the survey, ... in computing their triangles, and bringing up the field work and...the memoirs. ...

The surveyors returned to the field duty about the middle of January; but the senior assistant, Turnbull, was obliged to relinquish it from fever on the 15th. He again resumed... on the 31st, and on the 10th February again was obliged to return to Dindigul. ... He left Dindigul on the 5th March, but...to return on the 20th.

On serious consideration of the continued...sickness wherein the Directing Surveyor, two assistants, and several followers, had greatly suffered from reiterated attacks, I judged it necessary...to call in all parties...to Dindigul, where the sick might receive medical aid, and the rest be employed in...completing the results of the field work. Within a few days...the Collector...transmitted a further account...of the general sickness that prevailed, whereby I had the satisfaction to find I had anticipated his opinion. ...

In noticing...the frequent ill health that the surveyors have been exposed to there, ... this is...equally applicable to all the mountains of the Northern Circars—...the hilly tracts of Nullmulla[3] [227, 266]—...and in those of Soonda, Bednore, and Malabar—whence their surveys should be attempted at certain seasons of the year only. The season in which this attempt was made in Dindigul was proposed by...Mr. Turnbull himself, ... tho' from a laudable anxiety he returned earlier than I could have wished in a convalescent state[4].

[1] MPC. 19–9–15. [2] ib. 3–11–15. [3] NW. of Cumbum [II, pl. 16]. [4] ib. 28–9–16.

The Dindigul survey was closed down, and the surveyors moved on to Travancore [105–6], except for Chamarett who was sent into hospital at Madras after being "repeatedly ill of fevers & obstructions, the consequence of the ill air of the hills"[1].

Death frequently came swiftly and from strange causes, but Sir Thomas Hislop did not succumb on the thirsty march to the Deccan;

You will be sorry to hear that an express arrived yesterday from Hyderabad stating that these was little chance of the Commander-in-Chief's recovery. His complaint is a constipation of the bowels, and has, it is thought, arisen from his travelling so long in a palanquin without his usual proportion of claret[2].

Two months after Riddell's sudden death in 1818 [318], Mackenzie writes of cholera in Madras and Calcutta;

Your account of the epidemic [in Madras] is really alarming, as it has been here. We lost two of our people here by it; amongst these was the poor peon that accompanied my Bramin from Madras [391]. He had served me nearly 20 years, and tho' he was brought early in the morning to our house he could not be saved. Some others of our people who took the prescribed medicine in time were saved. I believe it consists of strong opiates and brandy. We have it always ready, and Mrs. Mackenzie has dispensed it successfully according to our surgeon's directions, but it must be given early.

I make no doubt but that the medicines prescribed by the faculty will have its due effect with you as here. I recommend to you, Mountford, to keep some of the medicines in your house. ... Dr. Stuart[3] or any of your medical friends will give you directions. Few Europeans have died of it here, yet some have suffered, among whom was poor Mrs. Caddell, carried off in 24 hours. Major Caddell is now here, and pretty well[4].

We hear often of asthma, and Mackenzie was much concerned for James Summers, who was "subject to an asthmatic complaint"[5] [374–5];

I had expected that a change of air & employment in the field would have answered better than confinement to the desk in his hectic complaint. ... His consumptive complaint...has now reached such a height as to take from him all chance of being useful in the Department. He therefore requests...to retire on whatever pension his services may entitle him[6].

Summers lived about fourteen years after retirement [386].

Garling pressed in vain for a doctor to be attached to the Hyderābād Survey, "as attacks of a dangerous nature are generally sudden and rapid...and...individuals ...frequently detached at some distance from each other"[7].

It was just one year later that he himself died of cholera. The Hyderābād survey was indeed unfortunate, and ten months later Peter Conner succumbed a few weeks after joining the party. He had been

confined to his bed ever since his arrival, both with the bowel complaint and fever, and is at present in a dangerous state, that there is but little hope of his surviving. Doctor Voysey, the surgeon of Colonel Lambton's establishment, is affording him medical aid[8].

Conner had but recently marched his party up from Cochin, and had fallen in with cholera on the way;

We quitted Trichoor on the 1st of January [1821]. The transition of climate produced on many of our party injurious effects. On quitting the western coast, numbers became subject to a constant succession of feverish attacks, and on passing Salem the epidemic made its appearance amongst us. nor were we quite free from it till within a few marches from the Presidency. ... We had nineteen cases of cholera; in three instances it terminated fatally, and those who have survived are not yet fully recovered from its effects[9].

After closing the Travancore survey, Ward took his party back to Dindigul where survey had been abandoned five years before [*sup.*, 110], and his diary gives a fair picture of the climate they had to contend with;

Arrived at Dindigul on 17th January 1821. ... 18th. The assistants and followers came in, & some attacked with the cholera; one woman fell a victim this day.

[1] DDn. 156 (82). [2] Sir Thos. Hislop (1764–1843); C-in-C., Madras; Riddell to SG., 8–9–17; DDn. 151 (31); cf. Hasting's *Journal*—"17th Sept., Sir Thomas dangerously ill; 23rd., Out of danger". [3] Alex. Stuart, Mad. Med.; d. 1820. [4] Geo. Cadell (1783–1857) Mad. Inf.; Lt. 1800; Lt-Col. 1824; m. Susan —, who d. Calcutta, 1–6–18, aged 27. [5] DDn. 149 (19–22), 16–11–18. [6] DDn. 156 (41), 13–5–16 & 151 (162), 6–4–18. [7] DDn. 148 (100), 19–5–19. [8] from Hill, DDn. 147 (246), 27–4–21. [9] DDn. 192 (55), Feb. 1821.

19th. My butler, cook, and some women attacked this day; the usual remedies were tryed, but the disorder appeared to increase with violence.

20th. Another woman fell a victim this day.

21st. My butler fell a victim to it at 3 a.m. Cook still indisposed.

22nd. The cook died at 5 a.m. Proceeded to Madura at 5 p.m. ... My maity attacked.

23rd. Arrived at Madura at 7 a.m., and had a short interview with Mr. Peter[1]. ...

25th. Returned to Dindigul at 7 a.m.; McMahon & Keyes who were taken ill on the 21st recovered, as well as the other followers. Another woman fell a victim...last night. ...

26th. Ascended the fortress to take a station, but the weather being very unfavourable, and the hills cloud-topped, descended at 1 p.m. Keyes again indisposed.

27th. At 3 a.m. this morning I was taken unwell with a looseness and vomiting; administered the remedies instantly, and rose at 6 a.m. recovered, but excessively weak.

28th. Sunday. Indisposed. ... 31st. At 2 p.m. left Dindigul. ...

March 1st. Halted; rather unwell this day.

5th, 6th. Confined to my tent with a severe bilious attack. ...

May 27th, Sunday. Halted, my face being excessively inflamed & painful from exposure to the heat coming up the mountains, and in some degree owing to the change of climate. ...

June 13th & 14th. Halted & inked part of the work on the Tables; indisposed with a looseness which rendered me excessively weak, with vomiting. Symptoms similar to the cholera; was attended with no bad consequences. ...

July 16th. Rose a good deal indisposed. ... While proceeding to complete the only day's labor to be performed on the hills, attacked with a bilious fever, but with some assistance and support, exerted myself, tho' scarcely able to discern objects, and completed the task, and returned almost deranged at 2 p.m.

17th. Having been refreshed by a good night's repose, started at 7 a.m., and commenced the descent of the mountains to the plains. ...

18th. A return of fever worse than ever; continued much indisposed till the 24th, when I was relieved by throwing up large quantities of bile, attended with several evacuations. Weather excessively hot. ... Excessive weak & want of appetite continue till the 31st.

Ward then remained at Palni till August 27th, when he went out on survey again[2].

Montgomerie writes to him on the Malabar survey a few years later;

As the preservation of the health of your party is an object of the first consideration, ... in...any tract, the climate of which may be considered at all inimical, ... keep each individual actively employed during the day, and...so soon as the sun has set they should shut up their tents, which should invariably be pitched in the most airy situations.

The final drawing of the work may on such occasions be left for a more convenient opportunity, so as to admit of quitting the tract as soon as possible. It has...been observed that the hot weather is considered the best adapted for carrying on operations in such situations[3].

To the Surveyor General he writes that Ward intended

to carry his operations into the Wynaad district immediately on the breaking up of the monsoon, as the climate at that time is considerably more salubrious than at any other. But as this district is somewhat noted for a malignant fever at certain times of the year, it will be advisable that the party should quit it immediately on the indication of any febrile symtoms[4].

GREAT TRIGONOMETRICAL SURVEY

Though the forests and hills of the south peninsula have always been notorious for their fevers, we hear very little from Lambton about them, and it is possible that he was by constitution and age less liable to infection than most, and by disposition little given to dwelling on personal discomforts. It was far different with Everest, who on his first field season struck a particularly unhealthy tract at the very worst time of the year. He and his men were overwhelmed by a virulent type of malaria, and he remained personally most susceptible to malaria and other infections so long as he remained in India. He tells us all about it [229–32].

This does not mean that Lambton neglected the health and welfare of his people. At his request Voysey was appointed Surgeon to the Trigonometrical Survey, but

[1] Rous Peter; MCS. 1801; Collr. & Magte. Dindigul & Madura from 1812; d. Madura, 1828. [2] Journal, MRIO. M 25. [3] mosquitos requiring humidity; DDn. 228 (84), 20–2–26. [4] DDn. 218 (314), 21–8–26.

he suffered as much from fever as any other, and as his hands were more than full with his duties as Geologist, Lambton got him an assistant.

So much of his time has been taken up lately in the mixing of medicines and dressing, that he has had very little time to attend to his geological pursuits, and he has...mentioned to me the great convenience that would accrue from his having a *Dresser*. ... This, in the medical line upon the Coast, is a native or half-caste...in hospitals. As the expence...will be very trifling, and will add but little to my monthly abstracts, ... such an assistant will be of public utility in allowing Mr. Voysey more time to attend to...his other professional duties[1].

After Voysey's resignation in 1824, Everest had to rely on the nearest medical officer when he was within reach of one, and on the dresser when on the march.

We have noted Lambton's practice of taking the field during the rainy season when fever was rampant [223, 232]. In spite of the device which enabled Everest to work to lamps by night during the more healthy seasons [235], it was with considerable apprehension that he set out through the notorious Gāwilgarh Hills after Voysey's loss [243]. His departure from Hyderābād was delayed several weeks by a fierce attack of fever, and he had repeated relapses. It seems to have been a sort of rheumatic fever, something like that which worried Mather in Mysore [II, 109, 359], and affected his limbs so much that he had to be held up by his men when working at his observations [244]. In January 1824 his wretched state led him to apply for leave to Bombay,

and thence by sea to Calcutta. Since the begining of Angust last I have been unwell and from the 3rd Sept. until the present date...often very dangerously ill. My medical...adviser have frequently urged to me the absolute necessity of proceeding to the sea coast, but I know my presence to be so indispensably requisite to the success...of the Trigonometrical Survey, that I have preferred incurring every personal risk to absenting myself.

The favourable season...is now fast drawing to a close. I have succeeded in taking an excellent set of celestial observations for the further extension of the meridional Arc. ... All the important part is brought to a conclusion, and the little which remains to carry on the triangles to Hooshungabad may safely be entrusted to my sub-assistant, Mr. J. Olliver.

As I have...triangles running westward in the parallel of 10° 20′, which at some future period will be carried on through Poonah and Bombay [234-6], it is...necessary that I should ...make myself acquainted with...that part of the country, and I should...wish my journey to Bombay to be considered...professional duty. In that case my leave of absence will commence from the 1st May next and be extended to the end of September, by which time I hope to be able to rejoin...in perfect health. I...enclose...the opinion on my case by Mr. R. Riddell[2]... who, since the departure of Mr. Voysey, has afforded medical aid to my department[3].

By the time permission arrived Everest was better and had started into the hills, but he reports later to the General Officer commanding at Nāgpur, that

my health was in so alarming a state that I was under the necessity of applying for medical aid. ... Mr. Griffiths[4], the medical staff at Hoossungabad, came into the heart of the forests to attend me, since which time I have been a perpetual patient under his charge. ... I was a perfect stranger to him at the time, and had no claims whatever. ...

The operations of the Great Trigonometrical Survey of India have, since the month of February last, been within the limits of your Division, and my head quarters...at Hoossungabad [pl. 17], where they are still likely to remain for some months.

In the month of January last, the medical gentleman of my establishment [Voysey]... obtained permission...to proceed to Calcutta on urgent private affairs, leaving Mr. R. Riddell, of H.H. the Nizam's Ellichpoor Brigade, in medical charge, but this arrangement ceased...on my quitting His Highness's dominions, and I have since that time been altogether without medical aid. My establishment consists...of 2 principal Sub-Assistants with their wives and families, 3 inferior Sub-Assistants unmarried, 35 sepoys, non-commissioned officers, and...81 instrument attendants, besides camp followers. ... Almost all have...wives and families [396, 399].

Fortunately, until lately, my people have been very healthy, and if occasionally any cases of a serious nature occurred, I dispatched the sick persons to Hoossungabad, where they have been kindly taken care of by Mr. Assistant Surgeon Griffiths, but the case is now beginning to alter, and my sick are every day beginning to increase. ...

[1] DDn. 92 (106), 2-12-19. [2] Robt. Flower Riddell, MRCS. 1818, Asst. Surg. & Surg. Nizām's army, 1820-53. Bo. Med. 1825-7; d. London, 1866; Crawford's Roll, Bo. 531. [3] DDn. 171 (136-8), 16-1-24. [4] John Griffiths (1796-1841) MRCS. 1821; Ben. Med. 1819-41.

My department has been liberally supplied with medicine, ... but since the departure of the late Mr. Voysey, these have been, I fear, ill looked after, and are greatly in want of arrangement. ... I have no leisure to attend to these matters myself, even if I were sufficiently well informed, ... and my medical stores have...fallen under the charge of the...dresser, ... in whose judgement and discretion I place no manner of confidence. ... Accordingly...when I arrived at my head quarters Mr. Griffiths very obligingly took charge of them. ...

I now venture to request that Mr. Griffiths...be considered as in medical charge of my department from the 30th May 1821[1].

He writes later to the Surveyor General that Griffiths had

attended the sick of my department for the last four months, and has hitherto received no renumeration. ... I feel deeply indebted to him for the personal kindness...in this very painful stage of my disorder, and I must attribute...to his...judicious management that I have never been prevented from fulfilling my professional duties. Many medical gentlemen would have doubtless insisted on my abstaining from observing at night, sitting to calculate, etc., and would have attended me on no other terms; but...Mr. Griffiths...warned me of the consequences, and left me to pursue my course. ...

My original illness was a fever caused by too much attention to business, in consequence of which I was obliged to take mercury. I was recommended by the gentlemen of the faculty to ride every morning to perfect the cure, and on the 3rd September last year, in one of my morning excursions, I was wet through, and my left hip and loins, as well as my left shoulder, were immediately seized with the most violent pains accompanied by typhus fever [244]. This illness has continued to torment me...without intermission, and within the last 4 months has arrived at a crisis by the formation of a abscess at my hip, and another at my neck, from both which fragments of decayed bone have repeatedly been extracted, sundry incisions and other surgical operations of rather an unpleasant kind having been also...performed. ...

Since...my illness has in no wise resulted from any private folly or imprudence, but has been originally brought on, and subsequently protracted and aggravated by, my perseverence ...I humbly hope...that the Supreme Government will...grant to Mr. Griffiths such remuneration as will manifest their sense...of his services. ... Though the people of my department had ...unusual health previously to July last, yet...few of them have escaped an attack of fever, and there have been some very dangerous cases, so...the task imposed upon Mr. Griffiths has been one of much toil and fatigue[2].

Griffiths was allowed to charge his "dawk expenses" for the 40 mile journey he had made into the jungle "on a contingent bill certified upon honour". He was further allowed "sonat rupees fifty per mensem as a renumeration for his personal trouble and for every expense" during Everest's stay at Hoshangābād[3].

Though he carried on for another six months, Everest was now determined on leave to England. After closing work at Sironj he went to Calcutta, finished off his more urgent computations, and sailed for home in November [241].

After his departure Olliver spent an arduous six years triangulating eastwards from Sironj through the wild unhealthy country along the southern borders of Bundelkhand, and through Palamau and Chota Nāgpur, beyond the reach of medical assistance [261-4]. At the start, medical attention was given by the staff surgeons at Saugor, but trouble began when the party started out again in 1826;

Mr. John Peyton...had been for some days seriously ill of a fever and dysentry, besides a few other cases amongst the public followers, and Mr. Assistant Surgeon Mackinnon, then in medical charge, ... doubtless judging from the numerous sick at the station, besides the daily increase...by sick being brought in from the outposts, ... expressed himself in these words; "I should consider it a very imprudent step if you should venture out of the station till next month, for you would in the end regret so rashly exposing your party to a raging sickness".

Notwithstanding this caution I was seriously bent on setting out as soon as Mr. Peyton should be somewhat recovered, full satisfied that exercise with change of air would prove beneficial to convalescents.

As Mackinnon had prophesied, October and November proved sickly months and, writes Olliver, in addition to losing the services of Rossenrode for several weeks,

I this day buried one of my followers who fell a victim to a fever of only three days, and I have now in my small camp no less than six cases of fever. ... These are attended by the native dresser, ... but...as the department, in proceeding eastward into a most unhealthy

[1] DDn. 171 (236), 26-7-24. [2] ib. (277-81), 22-9-24. [3] BMC. 9-9-24 (174), DDn. 205 (86).

country, may even be deprived of the aid of the...dresser, should he be taken sick, and, as I shall not perhaps be within 60 or 80 miles of...medical aid, ... the department would eventually be reduced to a most deplorable condition[1].

The Surveyor General promised to arrange for an apothecary but none had arrived six months later, when Olliver wrote that "in consequence of the daily increasing sick", Rossenrode had abandoned work and come in with a train of sick to the number of 22, of whom 11 were...conveyed on cots, the remainder on private cattle. To heighten the disaster Mr. R. was himself laid up...when he alone had to attend to...the sick. ... The sick party will...proceed for medical aid either to Mirzapur or Chunar and, as it will depend on the chance of procuring bungalows, ... I am not yet certain which...I shall take up during the ensuing monsoon.

I earnestly regret the impracticability of allowing the only medical dresser...to proceed with the sick, for I shall require his attendance during the extension of the work now advancing into the same tract where so much evil awaited the advance party. I regret also...that since the arrival of Mr. Rossenrode's party, my people...are very disheartened at the idea of impending evil, added to the scarcity of provisions. ... I have not yet felt the effects of scarcity, but...the southern parts of Rewa...are miserably depopulated[2].

Two months later he reports from Mirzāpur that he had asked for aid to the sick sent in to Mirzapoor with Mr. Rossenrode, and...the Brigadier-General very readily issued the necessary orders to afford every comfort to the...sick, and soon after their reaching this, the whole were sent out of hospital. ... I...trust that the few sick at present who came in with me will also soon be restored ; the one who died on the way fell a victim to the cholera which, for the last four months, raged violently in Bundelkund and Boghelkund[3].

Season 1827–8 was equally unfortunate, and Olliver reports that during November and December, ... I have had to bury three of the followers. Several of the people are quite emaciated, and this evil has so panic struck the people that through a dread of further havoc, a few have even ventured to decamp, and a few have insisted on their discharge. ... I had...the greatest anxiety for the safety of the party, and in particular for Mr. Rossenrode and family, who were altogether violently laid up, as well as Mr. Torrick, of whose safety I quite despaired. He is now restored, but quite worn down.

I have myself been ill from the 24th of December, and but a few days back was most seriously laid up with the fever, and I have been obliged to make up to this little open amphitheatre for my recovery, and am now...quite restored[4].

He writes to the magistrate at Sherghāti ;

During the last few months almost half of the public followers...have been visited with the jungle fever, and in most cases followed by a dysentry, and the number of sick still bearing a large proportion to the strength of the party, ... I have [requested] Mr. Rossenrode to proceed in search of efficient medical aid to some station where the department may also be accomodated during the rains, ... about what time...it be advisable for me to quit the field, and to hasten to lodge...somewhere safe from the rains. ... It is not unlikely but that I may eventually be put to the hazard of being shut even from all communication by the flowing in of the rivers[5].

They spent the rains in Gaya, and Olliver again sent in a tale of woe [262].

GUARDS & ESCORTS

Except for surveyors working beyond the borders or with troops on active service, military escorts were not otherwise provided without special orders, such as were issued for the revenue surveys of the Upper Provinces ;

The Governor General in Council is pleased to resolve that a Guard of one naik and four sepoys, either from the Regulars, Locals, or Provincials, at the discretion of the Officer Commanding in the District, be attached in future to each of the Revenue Surveyors.

Whenever circumstances may require a larger guard, burkandazes[6] must be hired under the authority of the Revenue Surveyor General, who will make an immediate report thereof[7].

Bedford required such larger guard for his survey in Rohilkhand [152-5] ;

When our operations were commenced early in 1822, without either public instruments or other Government property, ... and when one party only was employed in the field, a guard

[1] DDn. 173 (28), 18-11-26. [2] ib. (54), 9-5-27. [3] DDn. 231 (9), 18-9-27. [4] Bijorah, DDn. 173 (73), 1-2-28. [5] DDn. 174 (140), 31-5-28. [6] Civil armed guard. [7] BTC. 24-12-23 (23).

of 1 Havildar, 1 Naik, and 16 Sepoys, was furnished...at the suggestion of the Judge and Magistrate. ... From Mr. Halhed's long residence in this district, and intimate knowledge...of the character of it's inhabitants, ... the necessity of a stronger guard than that furnished by the military authority...might safely rest on his opinion alone. ...

A guard of 1 naik and four sepoys appears to me not only inadequate to...effectual protection, ... but provides no resource against sickness in a...country peculiarly subject...to fever and agues, and at so great a distance...that, were one or two seapoys to be taken ill, ... our camp would be left for several days without even the protection of single sentry. ...

A spirit of conciliation appears so essential, and so many complaints formerly reached me respecting petty acts of aggression on the part of the native establishment, without the possibility very often of discovering the offending individual, that I at length determined upon sending a steady seapoy with every party...to prevent any plunder. ...

Many articles which are daily required...could not, without much inconvenience, ... be collected every night and sent to the guard, nor would the place where the arms and instruments are deposited be proper or safe for many of them. ...

Independent of the mere security of the public property, ... I...submit...whether...private protection may not reasonably be expected by any individual (as well for himself as for those under his command) employed on the public service in the field nearly nine months of the year, obliged...to have almost everything he owns about him. ...

I have been induced to entertain two parties, each consisting of a jamadar and eight nujeebs for the more effectual protection of Lieutt. Pemberton's camp and my own[1].

Most of the Madras parties were still working in distant unsettled districts, and Dunigan asked for a havildar's guard when working in Ellore, as he found a naik's guard insufficient. Guards from the Subsidiary Force were provided in the Nizām's dominions. The Nizām's officials were as a rule most courteous and helpful, and when a theodolite was stolen from Bird's tent, rupees 250 were recovered in the courts[2]. Mountford pointed out to Young that a guard was never refused "when the officer in charge of a survey has made an official application to the Commanding Officer of the Division or Force in the neighbourhood of the survey "[3].

When the naik's guard was withdrawn from the Madras office in 1823 Mountford asked for extra peons at night, when " the records...which have been prepared at so great an expense...require some protection additional to...mere bolts and bars "[4].

On Lambton's transfer to the Supreme Government, he asked that his permanent escort [II, 359] should be doubled to the number of

one jemadar, *four* havildars, *four* naigs and *forty-eight* sepoys. The guard which I have hitherto had...was sufficient in the Company's territories, but in these foreign dominions, ... so infested with prowling banditti, it would be unsafe to send out any party...with less than a havildar's guard, and...my escort is generally subdivided into several small parties.

My present guard does not belong to any regular corps. The sepoys are entertained by me, and paid, clothed, and armed by Government. I wish the same plan to be followed with the augmented guard, provided I can find persons to come into my service[5].

This proposal, together with others relating to his sub-assistants, was referred to Mackenzie, who took no action [324-5], and Lambton writes two years later ;

In the beginning of 1818, being anxious to render my establishment efficient, without waiting for a reply to my letter of the 28th November 1817, I increased my escort to the strength recommended in that letter. ... I included the pay...in my monthly account, the additional part of which...I have paid from my own funds since the 1st January 1818. Should the pay, ... as well as two years clothing, ... be struck out of my account, ... I shall be a sufferer to the amount of nearly seven thousand five hundred *rupees*. ... I acted without authority, but...I trust that the transaction will merit the consideration of His Lordship in Council[6].

Still receiving no reply, Lambton asked that if his full recommendations could not be accepted "the escort may at least consist of a Jamadar, one havildar, three naigs, and thirty sepoys". This was accepted[7], being an increase of only six sepoys on his old establishment [325].

After Everest took over he asked, without success, that this permanent escort should be disbanded and replaced by regular soldiers ;

This body of 35 men belongs to no regular corps, and its state of discipline is...far inferior to that of regular soldiery. My time is so much taken up with my studies, calculations, and

[1] BTC. 30-4-24 (101). [2] DDn. 192 (139), 23-5-21. [3] ib. (276), 25-10-21. [4] DDn. 200 (39), 21-3-23. [5] DDn. 63 (426), 27-11-17. [6] DDn. 92 (107), 15-12-19. [7] ib. (194), 17-7-21.

observations, that I have no leisure to attend to them, and as they are a considerable expense ...I...recommend that they be disbanded, and that the duties of protecting...the Trigonometrical Survey be performed by guards from the regular army. ...

A saving will accure of 320½ rupees per month, and...will...be adequate to maintain a number of hurkurrahs for...a dawk of communication with the nearest road, and a small establishment of artificers to repair my instruments.

He asked for pensions for the men discharged "because some of them are worn out in the service and...unable to gain a livelihood by their own exertions"[1]. Government refused either to allow regular soldiers or to provide the *harkaras* and artificers, and a year later Everest acknowledged the value of the old escort;

It is, I find on experience, by far the best plan to have an escort attached to the department, and quite independent of any regular corps. I thought differently at one time, but I am now thoroughly convinced of my error, and...no regular sepoys could ever have been half so efficient and useful as my men...in the tremendous forest and wilderness through which I have conducted my operations[2].

On handing over to Olliver in 1825, he recommended that the full escort should be kept on, and even then Olliver found that it did not meet all needs;

In the Mirzapoor District my parties have been more than once been subject to robbery, myself having been robbed one night, the greatest evil being in the loss of the public set of mathematical instruments. The empty case was, however, found about a hundred yards from my tent in the jungle, but the whole of the instruments were taken out. Even while...in quarters at Mirzapoor, no less than six times were my people robbed, notwithstanding the sepoy guards about the place[3].

In the Saugor area a special escort of irregular horse was allowed, two non-commissioned officers and 20 sowars, who were specially useful for postal communications, but Olliver could not obtain the same concession in Chota Nāgpur, even though a gang of dacoits had "fallen on my last pay party in the Singroulee limit". The "officer in temporary command at Benares" considered that the troops "would be liable to suffer great inconvenience" from "the distance you are from hence, and the nature of the climate"[4].

In 1830, at the instance of Lord William Bentinck who was intent on rigid economy, the Surveyor General, Henry Walpole, had to submit to a reduction of the permanent escort to one havildar, one naik, and 12 sepoys, allowing six months pay as donation to the jemadar and the two naiks who had to be discharged[5]. Eight years later, Everest pointed out that Walpole

seems clearly to have yielded a tardly and reluctant assent, ... founded solely on the plea that, the operations...being then carried out in the peaceable plains of Bengal, there was not the same necessity for an escort which had formerly existed. ... The escort consisted, prior to the reduction, of...well drilled men, ready for any service, highly subordinate and well disciplined, prepared to expose themselves to any fatigue, however arduous, or face any danger, however imminent. ... If Major Walpole had had any practical acquaintance whatever with the operations of the Great Trigonometrical Survey, he would have known that...it is fundamentally necessary that the men...should look to the camp of the Superintendent as their home, and be ready to go wherever they are ordered without a moment's hesitation[6].

SURVEYORS & THE PEOPLE

As a general rule surveyors and their followers had very little trouble with the people, and as they went about the country as Government servants, armed with letters of introduction to local officials, it was but seldom that they met with any obstruction. The arrival of a party of surveyors is apt to cause considerable disturbance to the quiet life of a country district. The Surveyor demands guides to show the road, and coolies to carry his kit, and brooks no delay. He has a strange desire to climb the summit of every hill, regardless of local superstition and prejudice. He brings a multitude of followers, and expects large quantities of food

[1] DDn. 198 (20), 23–6–23. [2] DDn. 171 (219), 9–7–24. [3] DDn. 173 (73–4), 1–2–28. [4] DDn. 174 (131), 31–1–28 & 175 (43), 7–3–28. [5] DDn. 265 (15), 13–4–30 & 175 (25) 23–4–30; BMC. 21–5–30. [6] DDn. 342 (100), 26–1–38; Geo. Everest (6, 7); *GTS. VI* (A. iv).

for man and beast to be delivered promptly at most inconvenient and out-of-the-way points. He asks impertinent questions about the value of crops and domestic details, which arouse grave suspicions. His intrusions were troublesome enough the Company's districts, but required a lot of explanation in the territories of an independent prince, where, in the remoter provinces, authority was but loosely maintained and the local people were quick to resent the advent of strangers.

Buxton got but little help from the people of Orissa, and complained of

the general supineness on the part of the more wealthy inhabitants in complying with the necessary requisitions of the Cuttack authorities, as well as the extreme unwillingness evinced by all classes, especially in the estates of the Tributary Rajahs, to afford that aid and information so essential to the speedy completion of a work of this nature[1].

No one was more conscious of all the difficulties to be met than Mackenzie, who as a young man had worked for many years in the Nizām's territories, and later in Mysore, where he had learnt the importance of sympathetic consideration of local suspicions, and the strict control of his staff [II, 366–9]. Before sending out his survey parties in 1815 and 1816, he warned his surveyors that,

on proceeding towards any provinces of the Company's possessions, whether on duty, on leave of absence, or sick, it is the duty of surveyors to apply previously for the necessary passports. ... The assistant surveyors should report themselves immediately in a respectful manner to the Magistrates, ... producing their passports, and renewing them as occasion may require [II, 142]. When occasion requires for going into...the territories of any of the Native Princes, previous measures should be taken for obtaining the necessary passports from the Resident[2].

Conner was advised not to press enquiries about statistics or history until the survey had made some progress and the peoples of Coorg had got to know him ;

I presume you are...aware...that expressing any extraordinary anxiety or solicitude for any particular object is the sure way to excite suspicion, delay, & sometimes opposition. ... I would recommend your abstaining from taking notes of your remarks, or of their answers to questions, in their presence. In this case they always suppose there is something more than meets the eye, & they assume caution...& distrust[3] [418].

Ward was directed to report to the Resident in Travancore

and communicate with him on the...mode of carrying on the surveys, ... and of obtaining such aids as are necessary. ... You are...to be particularly attentive to any instructions you may receive...and to conform with the official servants of the administration[4].

Mountford writes later that

Ward is well and Conner has arrived at Quilon. They have arranged...to set about their survey as soon as they have had an interview with the Resident. Of this I have approved.

All the reports from that quarter convince me that Munro [109 n.4], altho' he may have issued the orders required by Government, has not zealously befriended the survey. He has not given it that support which...he must know is necessary. This I am astonished at, as I had looked upon him as a warm supporter. ... The neglect...may have, in some degree, originated from Ward's being too *unobtrusive* which, with all his good qualities, he certainly is. Conner is more a man of the world...and will, I imagine, please Munro more. By his waiting upon him and...indirectly insinuating the subject, much, I hope, may be done. ...

I am afraid this is our only way of proceeding. A complaint to Government would, I imagine, tend to irritate, and might produce little effect, as a literal obedience of orders has probably already taken place. I have...desired them to be cautious in stating to me officially any complaints, ... and to take care...that it is not merely on the report of the assistants, but after particular investigation by themselves, and on grounds decided and well made out[5].

The interview was successful, and work ran more smoothly thereafter [109].

Mackenzie was anxious about *pindāri* incursions [82–3, 96, 100], and writes to the Collector at Bellary in 1815 ; "I hope the alarms from the Mahratta Horse are dispelled ; we...suspect they have some connection with the Canoul business[6]" ; and later after several raids had penetrated into Madras territory ;

The whole of these marauders will be on the retreat by the month of March, & retiring by a hundred different channels. Few of them will be crushed, & of what consequence compared to the havoc & destruction of their ravages ? It is shocking to think of it[7].

[1] DDn. 147 (246), 1–6–20. [2] MPC. 27–10–15 ; passports or *parwānas*. [3] DDn. 156 (19, 22), 11–1 & 6–3–16. [4] MPC. 10–5–16. [5] DDn. 151 (105–26), 13–1–18. [6] DDn. 156 (14), 17–12–15. [7] ib. (111), 8–1–17.

Several students of the Military Institution were victims of the raid into Guntūr in March 1816, and James Macdonald[1] [II, 321] reports that he was

out surveying on the 11th instant. On that day the reports concerning the Pendarrahs had such an effect upon...the inhabitants...that they deserted their habitations, and I could with difficulty procure a cooly to accompany me. ... I then began to pay some attention to these rumours but, without orders from the Instructor [Mountford, p. 96] or the certainty of the near approach of an enemy, I did not feel authorized to leave my survey on the morning of the 12th.

I rode to a rising ground in the direction of Guntoor to make enquiries regarding the approach of the Pindarrah horde and...I had not proceeded far, when thro' the fog...I observed four mounted armed men in chase. Being tolerably mounted I determined to make for Guntoor, but unfortunately as I approached that station, I saw the country for many miles covered with the Pendarrahs. They bore down upon me in all directions, and resistance or flight became alike unavailing. I was surrounded, knocked from my horse, stripped to the skin, and unmercifully beaten, and to crown the whole they gave me two sword cuts, some spear stabs—none of the wounds are serious.

I crawled into a grain field, and when I had regained some strength walked, naked, beneath a burning sun to Guntoor, in search of medical aid. Near the Pettah[2] I was again knocked down by their spears, but a few shots fired at them from a fortified house in the Pettah prevented them only from killing me. I then joined Lieutenants James and Tweedie,[3] and assisted in defending the Collector's treasure and cutcherry. My plain table and surveying instruments are, I am afraid [missing], but as the country is over-run with Pendarrahs I have not learnt their fate.

Yesterday I was for a subaltern rich, today I have not a rag to cover me. I therefore hope that, as I was employed on the public service, and have suffered a misfortune which I could neither foresee or prevent, that His Excellency the Commander-in-Chief will have the kindness to recommend...a compensation for the loss of my property[4].

Grimshaw[5] tells a similar story [344] ;

Whilst employed on survey, my tent was surrounded and attacked on the 13th of March by a considerable body of Pundaries who plundered, and afterwards destroyed, the whole of my baggage. ... I was suddenly attacked at a village 18 miles from Guntoor ; an advanced party of 12 horsemen made the first attempt to plunder me, but with the assistance of the two servants I drove them back about 20 yards. To my great mortification...my gun at this critical moment missed five successive times, or I must have shot the headman in command of the party, who came up close to me.

I now lost no time in trying to disengage my horses from their pickets, to give them a chance to escape, but I was cut off from my tent by a fresh party, who came up in another direction. Three men endeavoured to spear me ; two of the thrusts I parried off, the other went through my jacket. Thus completely surrounded, it was impossible for me to afford any further protection to my baggage, and the only chance of saving myself was to run into a tank that was close to me. I succeeded in the attempt, and the ground being very soft, the horsemen were prevented from following me.

It was now I lost the whole of my baggage. My horses and every article found useful by the Pindaries was carried off and the remnant of my property was set on fire and burnt. I was obliged calmly to witness this scene from the impossibility of making any further resistance, and from having...to escape up a tree to avoid the main body which then came up and, I should suppose, amounted to 1,500 men, as the space of ground they covered on their march I afterwards found to be rather more than one square mile.

When the party had plundered the village, they left it, and I set out for Amaravetty. On my arrival I informed the zemindar that the Pindaries had halted and dismounted at a tope 6 miles off. I...requested...what men he could spare from the defence of Amaravetty, and I was promised the assistance of 70 horses and some matchlock men. This party would have been fully adequate to a nightly surprise on a body of men very ill armed, and who sleep in the greatest confusion. But on stating my wishes that the party might be ready at 11 o'clock on the 13th, I was told the men would not be able to turn out till the next morning, and hence I was compelled to give up the project.

I...annex a...list of the articles...lost, which composed the whole of my baggage, and I trust to...Government for remuneration for the ruinous event that has befallen me. ...

[1] James Somerled Macdonald (1792–1843) ; Mad. Inf. Ens. 1811 ; Lt Col. 1842. [2] fort. [3] John Polglasse James, Ens. 1807 ; Lt Col. 1833 ; Maurice Tweedie (1787–1867) ; Ens. 1804 ; Lt Gen. ; both 2nd MNI., 1816. [4] petition 13–3–16 ; MMC. 17–5–16. [5] John Grimshaw (1793–1819) ; Mad. Inf. 1809, d. near Copaul Droog, Mysore [Cubbauldroog, pl. 11].

Arab horses ...	... 3	Drawing box, complete	... 1
Tent ...	... 1	Box of mathematical instruments	... 1
Table ...	... 1	Telescope ...	... 1
Chair ...	... 1	Compass, box ...	... 1
Couch ...	... 1	Saddles ...	... 2
Writing Desk ...	... 1	Bridles ...	... 2
Trunks, containing 24 suits of new cloathes ...	... 4	Boots, pairs ...	... 4
Regimental Jackets ...	... 4	Gold watch, with chain and seals	... 1
Belt, with breast-plates	... 2	Silver Tumbler ...	... 1
Regulation Sword ...	... 1	Small milk bowl ...	... 1
Sash ...	... 1	Large spoons ...	... 2
Regimental Cap, complete	... 1	Tea spoons ...	... 4
Handkerchiefs ...	... 4	Salt cellars ...	... 2
Regimental Greatcoat	... 1	Cruet Stand, complete	... 1

1 Canteen, containing plates, dishes, knives, forks, and glass ware.
Military and Mathematical Books'
Bedding ; a tent carpet, and a variety of smaller articles that were consumed.

Saved.—1 Baggage Tent
1 Shirt
1 Straw Hat
1 Pair of Trousers
1 Handkerchief

Similar claims were submitted by Borthwick and Cuxton [II, 321][1], the latter giving details of the "cloaths" he lost ;

1 Subaltern's Tent	9 Waistcoats	9 Towels
1 Baggage Tent	7 pairs of Stockings	4 pairs of Cotton Gloves
17 Shirts	14 Pocket Handkerchiefs	1 Flannel Gown
14 Pairs Pantaloons	7 Neck handkerchiefs	

The claims were passed after reference to the Governor in Council[2].

It was this sensational raid that led to more drastic military action against the *pindāri* brood. Lambton writes to Mackenzie of the

escape of the Pindaries with all their treasure, women, etc., which they took from the Guntoor District. Doveton [83–4] made a rapid march, but made a countermarch the next day, and the Pindaries passed over the very ground which he had left. I hope some decided measures will be taken respecting these freebooters, and with respect to the Nizam's country too, for it is in a miserable state ; robberies and murders committed everywhere with impunity.

I hope you will continue to write to me from Bengal, and I shall let you know occasionally what is going on in this part of the world[3].

Though Lambton makes little official reference to the disturbed state of the country, his long halt at Hyderābād from 1816 to 1818 was most certainly opportune [223, 237], and led Walker to give a vivid account of the *pindāri* ravages[4].

The Company's troops themselves were often unwelcome in remoter districts, as Van Heythuysen noted when he marched his detachment from Ganjam to Nāgpur through the wilder parts of Orissa, some time about 1822 ;

It is absolutely requisite that troops in progress on this...route should be provided with their own permanent carriage[5]. No carriage of any kind is procurable without compulsatory measures, in having recourse to which the native inhabitants become disgusted & quit their villages in alarm upon the approach of troops.

Finding all the villages about this place deserted...I naturally request...why such a desertion takes place. The replies are uniformly the same. The Bengal sepoys use us and our people so harshly that we are afraid to remain. They come into our villages & take without paying everything they wish. ... On being assured of protection & that any sepoy of my party offending should be punished upon the spot, I have...prevailed on them to return & at my departure have had the pleasure to hear the Madras sepoys praised for their behaviour[6].

It had for centuries been a custom of the country that officials had the right to call for labour, transport, and supplies, entirely free of charge, a practice known as *begāri*. This was definitely forbidden under a proclamation issued in 1820 ;

Whereas an unwarranted practice prevails in several provinces...of forcibly pressing certain classes of the inhabitants, ... under the denomination of begarries or coolies, for...carrying baggage or other loads from stage to stage, or village to village, Notice is hereby given that the continuance of this practice is henceforth strictly prohibited throughout...the Presidency

[1] Alex. Borthwick (1786–1817) kd. in action, Ganjam ; *Origin of the Pindaris* (103) ; Richard Cuxton (1789–1829) ; d. Tavoy ; both Mad. Inf. [2] MMC. 3–12–16. [3] DDn. 62 (140), 11–5–16. [4] *GTS.*, I (iv–v. A), quoted from Malcolm, I (430–1). [5] Provision was made for the hire of transport by troops on the march under BGO. GG in C. 1–5–19. [6] Fdbk. DDn. 162.

of Fort William. ... The present order is not intended to affect the authorized provisions which now exist, or may hereafter be found necessary, relative to the regulated supply of porters in the mountainous portion of the British Dominions on the North Western Frontier wherein other species of conveyance may not be procurable[1].

It was to this order that Everest refers in his letter of August 1832, when telling how times had changed [399].

Fisher tells of trouble on a visit to Cāchār, beyond the Company's frontiers [50].

Letters were...written both by the Magistrate and myself to Chowjeet Singh, and an answer soon arrived importing that, when he had despatched some business which detained him in the eastern parts of his country, he should receive my visit with pleasure.

After my arrival on the frontier, I was met by a person deputed to conduct me to the Rajah...as far as Govindpoor, his present residence. I arrived there on the 5th April, and immediately sent notice to the Rajah, who appointed the following morning for my audience. On my attendance, however, at the appointed time, I was informed that the Rajah was sleepy, and desired me to come again in the evening. This was accompanied by circumstances ...which induced me to request premission to return to Sylhet, on which an apology was sent, and notice that the Rajah should visit me in the evening.

In the evening he sent his Dewan to inform me that he was building a house for my reception, and that when I entered it he would see me. As I had now received some information of a design to imprison me, I repeated my request for leave to return into the Company's territory, alleging the duties I had to perform in Sylhet.

Receiving no answer, ... I caused my boats on the morning of the 7th to be dropped down the river, but...5 miles from Govindpoor was stopped by...troops who, levelling their muskets and cannon, threatened to fire upon the boats unless I immediately returned, and I now heard...that the Rajah had issued orders for the massacre of myself and all the people with me, including my escort from the Sylhet Corps[2]. ... Considering that by any act of violence I should incur a heavy responsibility, and that the proceeding perhaps originated in some mistake, ... I complied with the order to return to Govindpoor, under the express assurance that the Rajah would see me immediately, and allow me to take my leave.

The Rajah, however, again broke his promise, and...placed a guard to watch my boats, notwithstanding which I received information of his intention to murder the whole party. I was positively prohibited from writing to Sylhet, and every precaution was taken...to cut off the communication. When, therefore, the...Dewan and Thanadar appeared, to communicate the Rajah's orders for my entering the house assigned to me, I made enquiry of them concerning the cause of the Rajah's anger, and mentioned...my having surveyed the course of the River Soorma in my way. I was told that it was not on that account, and...that it originated partly from a belief of...the claim of the Company to Pergunnah Serispoor, and partly from an apprehension that my visit was only a prelude to a similar claim to Cachar itself.

Every chance of an amicable adjustment was at an end. I therefore siezed the three ministers and confined them in my boat, but was afterwards induced to allow one of them to fetch the Rajah's cousin, ... who, with all his counsellors, has strongly opposed the whole proceeding. ... Successively, ... the cousin and nephew of the Rajah appeared, and the latter, after being detained by me a short time, was allowed to depart...to bring the Rajah, or to return himself within two hours. In about an hour the Rajah came to the river bank, and publicly asked pardon, and...I expressed my fear that he had been induced to act as he had done through some misapprehension, which he replied that he had not, and again asked pardon.

The following day a passport was granted to me, and I was allowed to return to Sylhet[3].

Revenue surveyors worked as a rule in the closest touch with district revenue officers, and in the friendliest relations with local inhabitants. Brown, however, reports serious trouble in the Sahāranpur district ;

On my arrival at Teetroun, I found the boundary settlements at a stop. An armed mob from Gudhee Abdoolah Khan, instigated by the Puthans in that place, had forcibly interfered and driven the arbitrators from the boundary. I immediately reported...to...the Judge of Suharunpoor, who was at that time also officiating Collector, and aid was promptly given to Mr. Fraser's ameen. Two suwars were directed...for...apprehending rioters...and a proclamation was at the same time issued, stating the nature...of the Survey, forbidding violence, ... but to bring their complaints to Suharunpoor, where they should be immediately enquired into.

[1] Proclamation, 24–3–20 ; BGO. GG in C. 15–4–20 ; C-in-C. 19–4–20. [2] cf. Manipur incident of 1894.
[3] DDn. 213 (363–5) & 196 (18–21), 1–5–21 ; cf. *CG.*, May 1821 (86, 501) ; *As J.* Jan. 1822.

The suwars arrived immediately, but unfortunately the proclamation...was some days in reaching the Thanadar. ... In the meantime, the Puthans of Teetroun [158]...committed a violent assault on my camp followers, and beat some of them in the most cruel manner with iron-bound lathees, for which they were fined in the court of Suharunpoor. ...

The Puthans have, however, the upper hand in other matters besides boundaries, and which I cannot describe better than by...the way they treat each other's cattle. When a Puthan's bullock strays into a Goojur's field, he is quietly driven out and respectfully taken to his owner, but when the Goojur's unfortunate half-starved beast happens to commit the dreadful mistake of plundering the Puthan's field, the case is altered quite, and a dozen fellows are seen clustering to the spot, and the blows are heard to resound from the animal's back[1].

GREAT TRIGONOMETRICAL SURVEY

Lambton, being himself of a kindly and courteous disposition, had always set himself to preserve happy relations with the officials and peoples of the countries in which he was working. His survey was, more than any other, broken up into small isolated detachments which were dependent on the maintenance of good will, and encouraged to give way on any sign of unfriendliness. Without such a spirit work in the territories of the Nizām would have been impossible. In the following letter Lambton explains his needs to Charles Metcalfe who had recently taken over as Resident at Hyderābād from his old friend Henry Russell;

It may be satisfactory to you to know something of...the Trigonometrical Survey, and why so many attendants are requisite in the Nizam's country, while so few are sufficient in the Company's territories and in the Mysore.

The unsettled state of the Nizam's Dominions, ... and the suspicion...of all the zamindars and jaghirdars on seeing flags flying within their domains, rendered it necessary to have takeeds[2] from the Minister to all managers of districts to be sent forward with the signal flags. Two peons attend each flag, and generally two sepoys in order to prevent the bearers ...from being ill-treated. Of these signal flags there are generally six, so that at least twelve peons are...necessary. It most commonly happens that the mountains to which the flags are sent are rocky and covered with high forest trees ; in which case the assistance of the inhabitants is necessary, and it is the duty of those peons to wait on the manager with the takeed, who if he be a well-disposed man will order assistance to be given. If he is not, ... as constantly happened...to the eastward, ... negotiations were required, which did not always succeed.

Besides these twelve peons sent with the flags, eight more are kept with the camp, in the event of sickness, or to be employed by the Daroga (who is also a servant of the Minister), in collecting...whatever may be necessary about camp, such as straw, grass, fowls, etc. The daroga is generally attended by a moonshee...and six hircarrahs. ... The hircarrahs are employed...in carrying letters, and keeping...communication with...post office stations ; two in camp to carry letters, and the remaining two are ready in case of sickness.

When the camp is at any very great distance from the tappal (dawk) route, ... camel hircarrahs are absolutely necessary. ... In all the late excursions except the last, what with the natural difficulty of the country—the scarcity of provisions—and unaccomodating and often hostile disposition of the managers and headmen of villages—a much larger number of the Minister's servants were wanted, and particularly to prepare for those dreadful cases of sickness and mortality with which the party sent out in 1819 was visited [229–31]. ...

The Minister's servants must be regularly paid, or otherwise they will plunder every village they come near. ... I offered to pay them myself, and Mr. Russell...readily agreed to reimburse me from the Minister's treasury, and I had, besides, full powers to punish anyone who was found guilty. This...in a great measure prevented the evil, but...it is impossible to remove. ...

The Daroga, Moonshees, six Hircarrahs, the twenty peons, and perhaps a camel hircarrah, will...be fully sufficient, and if any of them can be dispensed with, it shall be done. ...

When I was in the Mysore, ... every amuldar had orders to comply with my requisitions, and pay particular attention to my flags, which I had frequently to sent to mountains fifty, sixty, and seventy miles distant, without knowing in what district they were. Great aid from the inhabitants was also wanted, and I have had occasion to employ two hundred people besides my own followers, to clear roads through almost impenetrable jungle, and to ascent mountains five or six thousand feet above the sea, where I had to remain sometimes for ten or twelve

[1] BTC. 18-9-28 (33). [2] letters of authority.

days with a bazar. These people were all regularly paid, ... and the bazar articles...were paid for according to the regulated prices, exclusive of their being carried up the mountains.

The sick people...were carried from stage to stage by village coolies, who were also regularly paid for their labours. In the late excursions in this country the Minister allowed one or two elephants for that purpose. ... There was an abundance of begaries who were both ready and willing, when they were sure of being paid. ... I have been particular as to regularity of payment and, except in one or two instances, I am not aware that there has been any abuse. ... A propensity to prefer complaints...upon very frivolous grounds is common[1].

Lambton asked Bombay to provide for Everest's wants on his branch series towards Poona in 1822;

Public servants to attend him for...procuring supplies...and...assistance from the inhabitants in clearing roads and ascending the mountains, and...carrying the sick, etc. ... All labour, as well as supplies, will be regularly paid for according to the fixed rates. ... Where we are obliged to ascend the highest mountains with very heavy instruments, we constantly stand in need of such assistance. ... Captain Everest will also want a guard from the Sepoy Corps. ...

With respect to...cash, I...request...directions to the Commissioner at Poonah, and the Collectors through whose districts Captain Everest may pass, to furnish...a monthly sum not exceeding five hundred (500) sicca rupees, for bills...on Messrs. Davidson & Co., my Agents at Calcutta. It is in this manner that my parties get supplies of cash, ... and it is for bills on my private agents that I get cash from the different Residents[2].

At the same time Everest asked the Commissioner at Poona that provisions be furnished at fair rates; that my people be protected from molestation when employed with my flags or night-lights, and that the aid of the inhabitants in carrying my sick, clearing roads, erecting piles, etc., may be afforded at my requisition, for all of which prompt payment will always be made at the established rates of labour[3].

The following is Everest's reply to a complaint he considered entirely frivolous;

It was my intention some days ago to lodge a complaint...against the writer...for...refusing to afford me that aid...which I...require, and...for encouraging robbers to come to plunder my camp. The very enfeebled state of my health, ... however, prevented me ...

The first part is against Shaik Jee, Aumil of the villages, ... for refusing to protect and furnish with provisions some people of mine, who were sent with a signal flag to an eminence in the vicinity. ... The second is against Meer...Khan, Aumil of S. ...for refusing to assist in furnishing my camp with provisions, grass, wood, and other common necessaries.

The third is as follows:—On each of the nights of the 3rd and 4th December, a robbery was committed in my camp by people who were traced...through Tullagaon. Application was made to the putil of that village, but his only reply was that he belonged to the Nuwab, and knew nothing about the matter. An application was afterwards made...to Namdar Khan, whose reply was in...offensive terms. ...

The urzee[4]...is...so loose and general that I am at a loss to understand what it alludes to.

On my arrival [at Takarkhera] I found it necessary to repair the buildings erected by the late Lt. Col. Lambton, which had most wantonly been injured, and in some parts destroyed. It was also found necessary to raise a small pile of earth and masonry at the south end of my base-line in order to overtop some trees. The villages in the vicinity...were called upon to furnish such aid as they could afford.

The whole work was at an end in 8 days, and...the maximum of aid contributed on any day by the whole united villages...was 5 pukhalies and 41 labourers, and the daily pay was 8 pice[5] to a puckalie, and 4 to a labourer, all of which I know was regularly disbursed.

It is...implied by the latter part of the urzee that provisions have been required by me at forced rates, but...a more false and malicious insinuation could not have been made. ... Two bunneahs have been furnished to my camp by the authorities, ... and no person whatever is allowed to interfere with...them or their neruch[6]. ...

In reference to the charge made against my people of illtreating the inhabitants; were it less general and vague, could it enable me to bring the fact home to any individual in my camp—I should feel...much indebted to the person who imputed it. ... It is equally wanton and malicious with all the rest. For though I am always ready to attend to complaints and redress them, and to visit with the most exemplary punishment offences of the nature here alleged, yet no such complaint has hitherto been brought to me[7].

Everest's relations with unsophisticated inhabitants of the jungle were uniformly good. He writes of scorpions, tigers, and Khōnds [262];

[1] DDn. 92 (172–7), 13–2–21. [2] DDn. 64 (101), 4–5–22. [3] DDn. 172 (2), 13–1–23. [4] petition.
[5] 4 *paisa* = 1 anna. [6] scale of prices. [7] to Major S., comdg. Ellichpoor Bde.; DDn. 172 (94–7), 16–12–23.

I had a small tent pitched at the top of the hill, and a larger one at the foot with my camp. ... One of my followers brought up one morning in a large jungle leaf a heap of these detestable insects [scorpions], which he and others had killed...in my lower tent. Upon counting them, ... there were, young and old, in number twenty-six. ...

The tigers, too, were very large and ferocious. The inhabitants of a hamlet near my station...were preparing, whilst I was there, to abandon their homes in consequence of the perpetual prowling of these animals around them. From that station I intended to take azimuths of verification ; but, when I sent out a party with a reference lamp for that purpose, it was necessary to surround them all night long with shouts and revelry, and the blaze of fires, and discharges from musketry, so that the observations, which should be made in peace and tranquility, became useless. ... Mr. Voysey had actually lost a person who was in attendance on him [243], and they used to be heard growling all round my camp and detached stations by all but me.

I never saw a tiger in the wild state in India. Not a man of mine had ever been carried off, though I had in my excursions with the telegraph line [269–71], and in the jungles of the Godavery [229–31], invaded...the forests in which they chiefly abound. And to this lucky cause, probably, may be attributed the belief which the natives generally entertained of my being possessed, by means of astrology, of some necromantic powers, so that tigers had no power to harm me or those who were under my immediate protection. ...

The faith placed in the healing powers of the great theodolite and other instruments employed at any time in observing stars were such that I have had people come many miles to entreat permission to bow down before the lower telescope of this imposing instrument ; and, strange as it may appear, it is no less true that men and women who had been lame or blind for years, others who had the palsy, and others again who were swollen with dropsy, were among my applicants.

The Goands who inhabit this mountain belt are a race whose principal occupation is hunting, but who engage to a certain extent in agriculture. ... They are honest in their dealings, blunt and plain-spoken in their language, and as much given to speaking the truth as their neighbours to the north and south are to the opposite propensity[1].

Everest indeed loved to paint the picture ;

To the north of the valley of Berar, and within a few miles of Ellichpoor, rises a vast chain of basaltic mountains which extends as far as the eye can reach, ... and appears to be covered with forests quite impenetrable. These wildernesses are almost destitute of inhabitants, and the few human beings who dwell there, a wretched set of wild Goands, are engaged in perpetual conflicts with tigers, and other wild beasts, by which, and the barrenness of the soil, they are frequently driven from the miserable hamlets.

Water is hardly to be met with, and provisions, unless brought from a distance, are nowhere procurable. The mountains viewed from the valley of Berar appear altogether interminable, and the features they present seem to rise ridge beyond ridge, so nearly equal in height as to preclude the possibility of selecting a series of suitable geometrical points ; besides which they are really the seat of the most deadly fevers[2].

Trouble met by Olliver at a hill station just north of the Narbada was probably due to local superstition, for the State officials were quite ready to help ;

I proceeded to the height which you pointed out, ... situated on the great mountains north of the Nerbuddah, subject to Bhopal, and in the midst of a desolate tract of country, covered with much forest. ... I could by no means persuade any of the inhabitants to afford me any aid. I could not even get a guide and, what is worse, the killadar of a neighbouring fortress...about 6 miles distant threatened to confine all my people.

There was a great scarcity of water, and no means of bringing it to the top of the mountain, and provisions were not to be had nearer than 8 miles, so that I could not, with due regard to the safety of your people, keep them upon the hill for 24 hours together.

I succeeded on the 17th in hiring 16 hatchet men from the Hoossungabad District, ... but these people were insufficient for the work, and left me on the 21st, thoroughly worn out. On the night of the 21st a native gentleman...arrived on the part of [the] Political Agent, ... but...not furnished with sufficient authority to procure me assistance. ... On the 21st I succeeded in clearing a gap in the jungle sufficient for the ray of N — to pass clear through, and on the 23rd I left the place, ... but...the station was still incomplete[3].

There was trouble in cantonments as well as in the jungle, and Everest complains to the commanding officer at Hoshangābād on behalf of his servant ;

[1] Geo. Everest (39–41). [2] to SG., 5–9–25 ; DDn. 171 (359). [3] ib. (207), 24–5–24.

The 1st complaint is...against the khidmutgar of Lt. M. for using threatening language towards him to the following effect : that he (Lt. M.'s servant) would sieze him immediately after dinner, and tie him to a banyan tree, and beat him so that he should never be able to rise again. The 2nd complaint is against the khitmutgar of Mr. Asst. Surgeon Griffiths, for calling him a bahunchoot, and threatening to break his arms and face. ...

I beg you will take such measures as...may seem proper. ... The complainant is a very peaceable and inoffensive man, and has been in my service for a long time, and is altogether a very trusty and excellent servant, my khansamah[1].

Everest was much concerned to impress everyone with the great importance of the Great Trigonometrical Survey, and the following is the style of letter he would write to political officers and others when asking for assistance;

The Trigonometrical Survey of India is a subject of deep interest to all the learned societies of Europe. ... It is in point of extent the greatest scientific undertaking of the kind that Great Britain has ever patronized ; and, ... stretching as it is likely to do from the parallel of 8 degrees to that of 31 degrees of latitude, it offers a wider field for the solution of...the true figure of the globe than any similar undertaking which the present generation will probably witness.

For myself, who am but the unworthy instrument appointed to conduct this magnificent work, ... I feel the most solemn interest in its successful accomplishment, because...it becomes me...to do my humble mite, that...my employers may meet with no dishonour. ... Without the presence of His Highness's servants, it seems to me impossible that operations can proceed; my own attendants will assuredly be beaten and ill-used in every village, and I shall neither ...get guides nor assistance from the inhabitants in any shape whatever[2].

The demands made were no doubt a considerable tax on the sparsely populated countries through which Everest and Olliver worked between 1824 and 1830. The survey constantly passed from the influence of one political officer to another who had little cognizance of its purpose, and from the homeland of one primitive people to another, each with the natural prejudice of jungle folk against strangers and works that passed their understanding. Not all were benevolent like the Khōnds. It is recorded that during Olliver's work the Rāja of Rāmnagar[3] "caused it to be proclaimed by beat of drum that his people should be cautious of falling into the hands of the surveyors lest they should have their children taken to burn in the signal fires[4]" Everest tells of difficulty in preserving the markstones intact;

The natives of India have a habit of attributing supernatural and miraculous powers to our instruments [414], and the sites which have been occupied by them. In cases of death or any other natural visitations they often offer up prayers to those sites ; and if the object of their prayers be not conceded, they proceed to all sorts of acts of destruction and indignity towards them ; Nay (as...my station-marks were engraved on the solid rock *in situ*), they have been known to proceed in bodies armed with sledge hammers, and beat out every vestige of the engravings[5] [245].

COMMISSARIAT AGENT

Everest was so much bothered by audit objections that he at length appealed for protection, pointing out that the items retrenched were necessary,

and the amount was advanced from my private purse in ready money. The contingent bills...are given in by me upon honour. It seems to me not only a great hardship that I should be liable to retrenchment after the lapse of 10 months, but that the...procedure is quite deficient in that civility which I am entitled to expect. ...

It is my anxious desire to be liberated from all concern with them [contingent accounts], for they are not only a source of much loss and inconvenience to me personally, but they take up the valuable time of myself and my sub-assistants. They involve me in perpetual squabbles...about annas and pies, and I am hardly ever free from...unravelling some tricks and roguery on the part of my native followers, who superintend my lights, clear my stations of jungle, and make my blue lights, &c. ...

There are certain items...which might doubtless...be supplied by the Commissariat Department. ... Stationery—sepoys' cloathing—station flags—teak flag-staves or masts—observing tents—repairs of do.—gunny bags—cotton ropes. ...

[1] DDn. 172 (204), 27-7-24. [2] to Resdt. Malwah & Rajpootanah ; DDn. 172 (217-9), 27-8-24. [3] 30 m. S. of Rewah. [4] *GTS.* VI. B(5). [5] ib. XII, appx. (60).

There are other charges which may not be so easily adjusted, such as—the charge for oil and earthen vases at the different stations [247–8]—the perpetual charge for candles, wax, and oil at the observatory—the perpetual charge for hire of labourers to assist in clearing the jungle, making roads for the instruments, and such other matters—the occasional charge for the carriage of the sick.

These and many other items...are a constant source of vexation and trouble to me, and they are (though altogether indispensable) a very heavy expence to the State. ... I would...suggest ...that a native agent...of the Commissariat be kept in continual attendance on me...to supply my wants on my requisition. ... The saving of expence would more than cover...his salary, at the same time that it would disburthen me and my sub-assistants from an office which interferes to a very injurious degree with the more important duties of my situation[1].

The agent was supplied in October 1824[2] [327], and amongst his first tasks was the provision of materials and labour for the construction of the Sironj observatory. Regarding ways and means Everest writes ;

Masonry is so seldom required in my operations that I can always depend upon the resources of the country, but...a small proportion of carpenters, smiths, and one good brazier will be of essential service. Major General Arnold [381] has been pleased to place at my disposal...a sufficient number of carpenters and smiths from the Saugor magazine, but there are no good braziers at that place, and they are the most important artificers to me. ...

There are no builders or woodcutters of any kind attached to the Trigonometrical Survey. I am not aware of any General Order which prohibits the calling for the labour of villagers, and if such an order does exist, I cannot conceive it at all to be applied to the Trigonometrical Survey [410–1]. ... Imagine how I could possibly have proceeded on the banks of the Godavery, where I had a full square mile of thick teak and bamboo forest to cut through, and...not within 50 miles of any full-sized village[3].

He was disgusted to find that he still had to countersign vouchers ;

It was the intention...in appointing a Commissariat Agent...to liberate me from the trouble and inconvenience, ... but if...muster rolls and certificates...are to be furnished from my office, the indulgence...will be completely frustrated, and...trouble will be increased tenfold. ...

In the present state of my health, I am unable to indulge in so voluminous correspondence. If Bunsedhur [the Agent] had presented his accounts...when the different items...are stated to have been incurred, I could have...checked them ; but he never did so and, ... preferred idling in camp. ... He cannot give any explanation, ... and declares that he did not go through the expense ; I beg to ask why he did not ? He had the most ample information, being almost the only idle person in my camp, and though...he could not control the expenditure... at distant stations, yet every one of these stations was visited in succession, and he might... have examined into...the statements given him by my people. ...

When Bunsedhur joined...I explained to him the system on which the contingent expenses...had always been checked. ... Bunsedhur chose to advance money to my people, and to take no measures whatever to control them. ... Captain G. calls on me for particulars as if I had kept any memoranda on the subject, but for this I have neither time, health, nor inclination. ... I must decline all further correspondence with Captain G., for there is a general incivility in that gentleman's style of address to me, notwithstanding all the trouble I have taken to meet his wishes[4].

In the course of further acrimonious correspondence Bunsedhar shewed his expenditure as Rs. 2,815–13–4, three-fourths advanced to Everest and his assistants, one-fourth expended by himself. After Everest handed over to Olliver, another Agent was appointed, and Olliver kept strict control over his bills. He still had to defend his expenditure ;

The quantity of candles and wax, though appearing large in one month's charge will... last out for two season or more. Candles are used in the observatory during the observations for reading off the micrometers ; ... making out the angles, and for comparing them all, which is done immediately after the observation. The quantity of candles used during the last 3¾ months is about 9 seers, so that about 3 seers may be considered the average expenditure for the month. ...

Wax...is made into tapers. ...

The Indian Ink...is very good. Its dimensions are 4·3 inches in length, 1 in. breadth, and 0·7 of an inch in thickness. ... It was bought up at a public auction...in a lot with other

[1] DDn. 91 (411), 29–7–24. [2] BMC. 2–9–24 ; DDn. 205 (85). [3] to Asst. Commy. Gen., 5–10–24 ; DDn. 172 (250). [4] ib. (363), 20–6–25.

colours for 41 Rs., and I eagerly availed myself by offering 10 Rs. for the cake, ... being the only article there in my opinion of any worth[1].

Such was the scarcity of supplies

felt by Mr. Rossenrode and his party, that actual starvation...was considered no uncommon thing. The Goands flee their habitations at sight of a stranger, and though Mr. Rossenrode had taken the precaution to lay in a stock of provisions for his party, laden on spare bullocks, ... yet his horses, only two in number, have frequently been obliged to subsist on small rations of rice, for the country yields no channa[2]. ... Fatigue, attended with privation and sudden change of food from wheat flour to rice, has been the cause of the sickness which the party experienced, irritated with the water oozing from sandstone [414]. ... The evil might be greatly remedied by the Commissariat...at Saugor being authorized...to provide...a transport depot of grain[3].

NIZĀM'S TERRITORIES

Though Lambton had maintained the smooth conduct of his survey through the Nizām's territories [412], the topographical survey had so many changes of leadership after Garling's death, that relations between surveyors and officials were frequently strained. There was the professional anxiety of the surveyors to collect all possible information, both geographical and statistical, regardless of local susceptibilities, a danger which Mackenzie had been so careful to avoid during the Mysore survey [II, 213]. There were many areas where authority was far from strict, and local *zamīndars* were apt to defy orders from headquarters.

In 1821, Thomas Hill who was holding charge after Conner's death, received a sharp protest from the Residency regarding his enquiries ;

You...have been calling upon the mootsuddies...not only for the names of the villages, ... but also for an account of the revenue and produce. ... It is certainly necessary...that you should be acquainted with the names of all places, ... but it is totally improper...to enquire into the arrangements of the country. ... You will immediately desist from such conduct[4].

Hill reports that Garling was allowed from the Subsidiary Force [I, 115–6]

a jamedar's guard, and the Minister's people, ... a chobdar, a nakeeb, 4 hircarrahs and 15 peons. ... His way of travelling was—a large marquee 12 feet square—a small double-poled tent 15 by 9, both with double wallings—and a baggage tent. One private tent for the sepoys from the Commissary's Department, and one for the Minister's people, with an elephant...(as the soil generally being of a loamy kind and somewhat injurious to horses), and 3 camels ; ... besides these, he had carts and laden bullocks of his own.

At present I have obtained from the acting Resident an havildar's guard, consisting of 1 havildar, 1 naique, and 12 sepoys ; one mootsuddy, 5 hircarrahs and 16 peons[5].

Young agreed that assistance was no longer generous, and that the new Resident, Charles Metcalfe, could offer no prospect of reverting to earlier conditions ;

He had no connexion with the survey, except to make application...for the Nizam's permission, and to remove any obstacles. ... In the Nizam's country the obstacles opposed to a surveyor are more numerous, and not so easily removed as in our own territories, particularly if the Government seems not to take an interest. ... Reference to the Resident is not always practicable from remote parts...where there may be no tappal communication [325 n.1].

The survey of these dominions must of course be...of great importance to Government, although the Nizam may feel no interest in it. ... It appears very desirable that...the same plans as heretofore should be followed. Mr. Metcalfe is disposed to remove obstacles when the particular instances of them are made known to him, but these...would be of much less frequent occurrence, and the survey less liable to be retarded, if the party were more countenanced and aided in some way...that may not...incur any direct additional expence to the Nizam's Government[6].

Metcalfe was reluctant to claim too much ;

A mootsuddy...or any other efficient person...at the headquarters of the Surveyor, with... hircarrahs or peons sufficient to furnish one for each surveying party, is all that is requisite. If, however, Captain Young will explain for what purpose he requires a larger body, ... such as the Nizam's Government can reasonably be called on to supply, the Resident will...renew his application. ...

[1] DDn. 174 (96), 20–3–27. [2] Indian corn. [3] ib. (100), 5–4–27. [4] DDn. 184 (160), 12–6–21.
[5] to Young, ib. (138–40) 2–8–21. [6] from Mountford, DDn. 194 (18–20), 19–1–22.

Captain Young...observes—"For myself I can get nothing, either to eat or drink"—The Resident has no doubt that the Nizam's Government will cause every facility...in procuring supplies. ... The Resident cannot perceive...any symptoms of insurmountable obstacles. The occasional absence of Patels...—ignorance...of the particular points which a surveyor may be anxious to ascertain—and general reluctance to furnish information of which the search is an object of universal...distrust, are inconveniences...which must be expected. ...

Every traveller who obtains a villager to shew the road pays, or ought to pay, for his services, and...labouring villagers compelled to attend the survey are entitled to their established hire. This...does not, of course, apply to Patails or heads of villages, who are officers of Government, and liable to occasional attendance for public purposes[1].

Young described the various subjects on which he had to collect information—boundaries—administrative centres—commerce—prosperity. He repeated his complaints regarding personal supplies. Metcalfe expressed little sympathy ;

We have no right to...such active labour for...so minute a survey of dominions of a Foreign Prince, ... which is notoriously viewed with...dislike, as if...a prelude to our taking possession of the country. It is therefore fortunate that the Government has volunteered the assistance required, and I trust that your operations may proceed without any impediment. But I shall not be astonished if the proposed...census...meet with objection [II, 213, 367].

I am surprised and concerned to find that you are exposed to difficulty in procuring supplies for your personal convenience, as my former instructions...particularly called...attention to this subject. They shall be repeated[2].

The Surveyor General readily accepted the Resident's point of view ;

That such liberal support should be given by the Nizam's Government...is gratifying, and I hope that Captain Young will be very careful that no acts of his assistants may tend to create jealously. I am not at all surprised that the Nawab should shew aversion to the injudicious attempt to take a census of the inhabitants and subjects of a foreign state.

A geographical knowledge of the country...should be obtained in such manner as not to excite that suspicion which too minute enquiries will certainly raise. A judicious... Surveyor will...give sufficient information on geographical and military subjects from his own observations, but...should be very watchful over the acts of his assistants[3] [408].

In spite of these directions, protests from local officials and from the Resident were repeated two years later, probably owing to incautious demands made by newly posted assistants, and in 1824 Crisp had to issue a special circular ;

First. That all supplies purchased from the natives be paid for at their own established prices, and no attempt be made to exact them at a lower rate, or to pay less than is demanded.

Second. That...persons...engaged be paid their regulated hire ; and on no account are they to be gratuitously employed, or to be pressed to serve unwillingly. ...

Third. Trading is peremptorily forbidden, for, under cover of the surveyor's occupation, and...his baggage passing without search, ... articles of merhandise have been introduced, the payment of duties evaded, and the Government defrauded.

Fourth. All oppression and maltreatment of a native will be visited with severity. ... Indeed mildness, patience, forbearance, moderation and justice, should characterize all your dealings, ... and especially, as you are employed upon a duty which cannot but be viewed with some degree of jealously and distrust, it should be your great care to conciliate. ...

You are directed particularly to confine your enquiries to such points only as refer to external objects, as boundaries, names and situations of villages, and carefully to abstain from questioning the people about any matters relative to the internal management of the country. ... Avoid minute statistical enquiries which tend to awaken suspicion and alarm[4].

From 1827 or earlier, a European superintendent was stationed in each division of the Nizām's dominions, and surveyors were directed to apply to him for any special assistance they required.

COMMUNICATIONS

Arrangements for postal service by means of *dāk*-runners, *tappal*, *harkaras*, and camel *harkaras*, have been already described [I, 303, II, 110, 334, III, 269].

[1] DDn. 194 (50), 5-3-22. [2] ib. (65-5), 14-3-22. [3] DDn. 198 (77), 3-5-22. [4] DDn. 147 (149-51), 14-9-24.

Communication between Government offices at the towns was maintained by postal packets "under flying seal", which were despatched in special bags, and were much more speedy than the public mail. Special Government sanction had to be obtained for the franking of letters whose official nature was at all in doubt, that they might be so included and allowed to pass free of charge.

Boat journeys on the Ganges and Jumna varied according to whether they were down the river with the current; or up the river against it. The downward journey from Cawnpore to Calcutta could be made in ten days in September, whereas the reverse journey, even for the Governor-General, might take more than two months[1]. Travelling by road *dāk*, the up-country journey could be reduced to less than fortnight. The despatch of maps during the rains was a serious matter, and they were often damaged when sent by *dāk-bhangi*, or parcel-post [358]. Mackenzie acknowledges a map from Morrieson

which is neatly done. ... Always send...letters...by dawk, & not within the roll of plans, because the latter take more time by bangy. The rolls of maps...are not immediately opened at all times, but wait for a convenient time, while letters are instantly opened[2].

Sea journeys between Calcutta and Madras depended on the monsoons—S.W. from July to September—N.E. October to March [I, 303]. Mackenzie's letter, written in Calcutta 18th August, reached Riddell in Madras on 6th September, in spite of the S.W. monsoon. The assistant surveyors who failed to catch a ship from Masulipatam before 1st December had to march to Bengal by land, or wait for a ship till March [374], and Mackenzie wrote to Riddell at the end of September ;

The season is now about to change, and after the 10th October I expect no more from you by sea. ... I would not wish for 6 months that any risks should be run[3].

On July 12th 1823, the Hon. Company's steamer *Diana* was launched at Kyd's dock at Kidderpore [I, 347] the first vessel propelled by steam and paddles to be navigated east of the Cape. She was built for river traffic only, and was used on the Irrawaddy during the advance of General Campbell's force towards Ava. Other river steamers followed, the *Irrawaddy* and *Ganges* being launched early in 1827.

James Du Vernet took nearly eight months on his first voyage to India, 1823–4. In 1825 the steamship *Enterprise* sailed from Falmouth on the 16th August, and reached Calcutta on 9th December, after a voyage under sail and steam combined. She was commanded by James Johnston[4], formerly of the Royal Navy, who had taken a leading part in organizing the voyage and won the *lakh* of rupees offered by Calcutta merchants. The time taken was considered so disappointing, 115 days instead of the expected 70, that the *Enterprise* was sold to the Government of Bengal, and never attempted the return voyage. She was sent to Rangoon under Johnston's command for service in the Burmese war, and was later employed "in towing sailing vessels up and down the Hooghly"[5]. On her first voyage she had been piloted up the Hooghly by Thomas Waghorn[6]. Inspired by Johnston, Waghorn initiated and organized of the overland route via Suez and Alexandria, making his first outward journey between November 1829 and March 1830, four months and 21 days between England and Bombay, which was then about the time of a good passage by sailing ship round the Cape. Waghorn devoted the rest of his life to the overland route.

[1] Evan Cotton (178). [2] DDn. 156 (136), 12–8–18. [3] Puri, 26–9–20 ; DDn. 149 (141). [4] Comdr. James Henry Johnston (1787–1851) ; RN. ; at Trafalgar ; Controller of E.I.C.'s steamers, Calcutta, 1833–50 : d. at sea off Cape ; MI. Kidderpore ch. *DNB.* ; Pankridge (53). [5] *Overland Mail* (7–9) ; Prinsep. [6] Thos. Waghorn (1800–50) ; RN. 1812–7 ; Hooghly Pilot, 1819–24 ; comdg. gunboat, Arakan, 1824–6 ; *DNB.* ; *DIB.*

Further Abbreviations

A Q M G.	Assistant Quartermaster General
A R.	Astronomer Royal
A S B.	Asiatic Society of Bengal (later Royal)
Acc/d/y	Accompan/ied/y
Acct.	Accountant
Actg.	Acting
Adjt.	Adjutant
Adm/n/ve.	Administra/tion/tive
Adv/d/t.	Advocate/Advertise/d/ment
Allce.	Allowance
Appce.	Apprentice
Appx.	Appendix
App/d/t.	Appoint/ed/ment
Appn.	Application
Archæol.	Archæological
Arr/d/g/l.	Arriv/ed/ing/al
Art.	Artillery
Asst/ce/d.	Assist/ant/ance/ed
Astr.	Astronom/ical/er
Attd.	Attached
Attdt.	Attendant
Auth.	Author
B N I.	Bengal Native Infantry
b.	born
bapt.	baptized
Barr.	Barrister
Bart.	Baronet
Batt.	Battalion
Bde.	Brigade
Bkmr.	Barrackmaster
Bot.	Botanical
Brig.	Brigadier
Bro.	Brother
Bt.	Brevet
Bur.	Buried
CB.	Companion of the Bath
CD.	Chief Draughtsman/Court of Directors
C E.	Chief Engineer
CO.	Commanding Officer
c.	approximately
Camb.	Cambridge
Cant.	Cantonments
Capt.	Captain
Cath.	Cathedral
Cav.	Cavalry
Cem.	Cemetry
Cert.	Certificate
cf.	compare
ch.	chapter/charge/chief/church
Chmn.	Chairman
Chpn.	Chaplain
Civ.	Civil
cl.	class
co.	company/county
Col.	Colonel
Coll.	College
Comd/d/g/r/t.	Command/ed/ing/er/ant
Comm/t/y.	Commissar/iat/y
Comp/n/r.	Comput/ation/er
Contt.	Contingent
Corn.	Cornet
Corr.	Corresponden/ce/t
Cous.	Cousin
cr.	created
ctml.	courtmartial
D/A/A G./QMG.	Deputy/Assistant/Adjutant General/Quartermaster General
DD.	Doctor of Divinity
D L.	Deputy Lieutenant
d.	died
dau.	daughter
Dett.	Detachment
Dir.	Director
Disch	Discharged
Dmn.	Draughtsman
Dsm.	Dismissed
dsp.	died without issue
ed.	edited/educated
Edn.	Edition
eg.	for example
Emp/t.	Employ/ed/ment
Engd.	Engraved
Engr.	Engineer
Ens.	Ensign
Est.	Establishment
Ex/Engr./Offr.	Executive/Engineer/Officer
Expn.	Expedition
F M.	Field Marshal
F R/A S/As Soc/S/GS.	Fellow of the Royal/Astronomical Society/Asiatic Society/Society/Geographical Society
Fd/Engr.	Field/Engineer
Frpce	Frontispiece
Ft.	Foot/Fort
Furl.	Furlough
Fwkr.	Fireworker
GC/B/SI.	Grand Cross of the/Bath/Star of India
GT Road	Grand Trunk Road
Gdns.	Gardens
Gen.	General
Geog/l/y	Geograph/ical/y
Geol/gt	Geolog/ical/ist
Gr.	Grammar/Grenadiers
Gt/G.son	Great/Grandson
HM.	His Majesty's
HdDmn.	Head Draughtsman
Hdqrs.	Headquarters
Ho.	House
Hon.	Honor/able/ary
Hospl.	Hospital
ht.	height
Hydrgr.	Hydrographer
I.	Island
I N.	Indian Navy
Infn.	Information
Inst.	Instrument
Instr/n.	Instruct/or/ion
Intpr.	Interpreter
Inv.	Invalid/ed
JP.	Justice of the Peace
Jt.	Joint
Junr.	Junior
K/CB/H/LS.	Knight/Commander of the Bath/Hanoverian Order/Lion and Sun (Persia)
Kd.	Killed
Kt Bach.	Knight Bachelor
L I.	Light Infantry
L L D.	Doctor of Laws
L M S.	London Missionary Society
LRCS.	Licentiate, Royal College of Surgeons.
Lat.	Latitude
Lib.	Library
Lieut.	Lieutenant
Lt.	Lieutenant/Light
Lith/d/r.	Lithogr/aph/ed/er
Long/l.	Longitud/e/inal
MA.	Master of Arts
M A G.	Military Accountant General
M D.	Doctor of Medicine
M Gen.	Major General
M I.	Monumental Inscription
MMI.	Madras Military Institution
M/P/RCS.	Member of/Parliament/Royal College of Surgeons
M S.	Military Secretary
m.	married/miles
mc.	medical certificate
Mad Eur.	Madras European Regiment
Mag.	Magazine
Maj.	Major
Mar.	Marine
Math/l/n/s	Mathematic/al/ian/s
Mdpmn.	Midshipman
Meas/d/t.	Measur/ed/ment
Med.	Medical/Service
Merch.	Merchant
Merl.	Meridional
Meteorl.	Meteorological
Mqs.	Marquis
mo.	Months
N E I.	Netherland East Indies
N I.	Native Infantry
Nat.	National/Natural
nr.	near
ns.	new series
Nvgn.	Navigation
Ob.	Obituary
Obs/d/g/n/y	Observ/ed/ing/ation/atory
Off/d/g.	Officiat/ed/ing
ord.	ordained
os.	old series
PA.	Personal Assistant/Political Agent
PM.	Afternoon
P S.	Private Secreatry
P W I.	Prince of Wales Island, Penang
pm.	per mensen; monthly
pr.	probably
Pref.	Preface
Princl.	Principal
Prof.	Professional
Provs.	Provinces
ps.	*pagodas*
Pte.	Private
Pymr.	Paymaster
Qmr.	Quartermaster
R A.	Royal/Academy/Artillery
R Adm.	Rear Admiral
R/AS/As/Soc.	Royal/Astronomical Society/Asiatic Society
R/E/M.	Royal/Engineers/Marines
RM/A/C.	Royal Military Academy/College
R/N/S.	Royal/Navy/Society
R S G.	Revenue Surveyor General
R U S I.	Royal United Service Institution
Recce.	Reconnaissance
Recd/d/g/n.	Recommend/ed/ing/ation
Regr.	Register
Regt/l.	Regiment/al
Res/d/gn.	Resign/ed/ation
Resd/t/cy	Residen/t/cy
Ret/t.	Retire/d/ment
S & M.	Sappers & Miners
sa.	sicca
Sectt.	Secretariat
Senr.	Senior
Sgt.	Sergeant
Soc.	Society
Sub-Asst.	Sub-assistant Surveyor
Subsy.	Subsidiary
Succ.	Succeed/ed
Sup/dg/t.	Superintend/ing/ent
Suppt.	Supplement
Surg.	Surgeon
Surv/d/g/r.	Survey/ed/ing/or
Svy.	Survey
Topo.	Topographical
tr/n.	trans/ferred/lated/lation
Trg/n/d/tg.	Triangulat/ion/ed/ing
Trig.	Trigonometrical
Uncov.	Uncovenanted
und.	undated
Univ.	University
unkn.	Unknown
unm.	unmarried
Ven.	Venerable
Vet.	Veterinary
Vol/r.	Volume/Volunteer
W I.	West Indies
y/r/st.	young/er/est

Moulagool a pass into Assam
1982 ft.
1524 ft.
J Y N T I A
Lopee N.
River Soormah
of
Keroowah N.
Balasera N.
C A C H A R
Daneshur
Gelalpoor
Topkhanah
Dukhinah
Pergh. Inchamuttee
Kurabulla
Chagaon.
Tarapurtabpoor
Syudnugur
Peer konah
Koaramuttee
Bateegaon
Nukteepura
Mafsoogaon
Shahpoor
Sonapoor
Meer Afsum
Beruhputtee
Takroomakee
Captainpoor
Demargaon
Pergh. Shybagh
Rajgroo kimuttee
Jypoor
Peenagur
Byarpoor
Chapnagur
Oottumagur
Dum Dum B.

Plate 19

SYLHET—JAINTIA FRONTIER

Reduced from Fisher's survey of 1822 [49–50]. Heights given above level of Surma River.

Boundary between Sylhet and Jaintia as surveyed by Fisher is shewn by firm red line with a second line indicating disputed area.

Reg. No. 4854 H D '50–800'52.

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BIOGRAPHICAL NOTES

ADAMS, Henry [II, 376]. Bo. Inf.
b. 21-1-1789. d., Sātāra, 4-6-29.

Ens. 1-1-07 ... Bt. Capt. 1-1-18; Capt. 14-7-22.
Son of John Adams, of Aberdeen, seedsman.
m., 11-11-19, Christiana Louisa, sister of James Cruikshank [435].
1812-9, on rev. svy. Broach and Gujarāt [170]; before 1818 survd. routes through Atavisi [122 n.3].
6-9-19, to rev. svy., Sātāra [7, 126, 171, 281, 344, 432].

AIRE, James Ritchie. Ben. Inf.
b. 6-12-1792. d. Agra, 2-5-27, MI.[1]

Ens. 21-7-10 ... Bt. Capt. 24-4-24; disch. by ctml. 24-4-27.
Son of John Aire, Lieut. RN., and Christian Ritchie, his wife.
No record found of marriage, but father of John Geo. Aire, b. Feb. 1814, who d. as writing master, Agra Coll, 22-2-64, and was bur. in same grave.
Hodson, I (14-5); III (733); Blunt (71/278).
Arrd. India Oct. 1809; with Pioneers till 1821; 1822-5, comdg. a Beldar Corps; 1822, as DAQMG. survd. roads in Singhbhum [27].
1827, found guilty by ctml. of insubordination and issuing bad cheques.

ANQUETIL, Thomas John. Ben. Inf.
bapt., Jersey, 17-12-1784. kd. in action, 12-1-42, on retreat from Kābul; MI. St. John's Ch., Calcutta.

Ens. 25-3-05 ... Lt Col. 14-3-33.
Son of Thos. Anquetil and Marie Poingdestre his wife.
DIB.; Hodson, I (39).
Marātha War, 1817-8; mil. route svy., Bundelkhand [82].

APLIN, Christopher D'Oyly. Ben. Inf.
bapt. 14-4-1787. d. at sea, 13-5-33.

Ens. 4-9-06 ... Capt. 25-12-22.
Son of Oliver and Mary Aplin.
m., Cawnpore, 27-10-18, Julie dau. of Sir Dyson Marshall, KCB., Ben. Inf. (Hodson, III 230-1).
Hodson, I (42).
1819, DAQMG.; 1820, map of roads, Farrukhābād Dist., MRIO. 25 (18).

ARTHUR, George Munro. Mad. Inf.
b. 30-3-02. d. Aug. 1870.

Lieut. 19-6-20 ... Lt. Col. 27-6-57; ret. as Hon. MGen. 10-10-58.
Son of Rev. Robt. Arthur, minister of Resolis, Cromarty, by his 3rd wife; half-bro. of Thomas [II, 376].
ed. Aberdeen Univ. *Oriental Club.*
27-6-23, appd. Asst. Survr., Hyderābād Svy., from 2nd NI., Belgaum [118]; Sept. 1824, to ch. Malabar Svy. [114, 342]; 10-1-25, sick leave to Europe.

AUBER, Charles. HM. 67th Foot.
b. 30-7-1790. d. Prome, 8-6-25.

Lieut. 67th Ft. 6-7-15; 83rd Ft. 11-12-23.
Son of Peter Auber and Anne Page, his wife.
Marātha War, 1818; MRIO. 81 (34-6), original svy., beautifully drawn with two reductions, of route HM. 67th and 1st Batt. 6th BNI., Rājputana to Baroda. "Very nea route survey. ... Talents deserve encouragement": grante allce. Rs. 250 pm.[2] [209].

BAKER, William Way. Mad. Inf.
b. 15-5-1801. d. of cholera, 30-11-39. Tumkur, Mysore, MI.

Lieut. 4-6-18; Capt. 17-9-27.
Son of Sir Robt. Baker, Kt., ch. magte. Bow St., London.
Left widow and 5 children.
Ben. Regr. 488 (120) Map of Tavoy in 9 sheets, und.

BALL, Thomas Preston. Mad. Inf.
b. 21-11-1791. d. 20-12-29, nr. Ahmednagar.

Ens. 3-7-07 ... Capt. 24-3-22.
Son of Rev. John Ball, of Dublin.
m., Hannah Anne, who d. 11-6-71, aged 70.
Feb. 1808, MMI. cl. IV [II, 320].
1818-9, compiled maps to illustrate Blacker's *Memoir of the Mahratta War* [86]; AQMG.

BAYLEY, James [II, 381]. Mad. Inf.
b. 5-7-1783. dsp. 11-8-45.

Lieut. 21-9-04 ... Maj. 21-6-27; ret. 4-7-29.
Son of James and Margaret Bayley, of Manchester.
The Bayley Family; Family Records. Oriental Club.
April 1805, MMI. cl. I [II, 320]; 1807-11, with Lambton's svy. [II, 242-4].
1811-3, Java; 14-9-12, AQMG. [II, 294, 323; III, 337]; 1813-4, to Bengal with Gillespie [II, 466]; Aug. 1814, returns to Madras army via Nāgpur, survg. *en route* [II, 53-4].
From 1-1-16, Asst. to QMG. in the Field, employed on svy. of *ghāts* E. of Ajanta towards Ellichpur[3], and defence of passes during operations against *pindāris* [84][4].
MMC. 24-6-17, placed under Resdt. at Nāgpur and from 6-11-17 appd. Supdg. Officer, Nāgpur cant.
Marātha War, 1817-8; severely wounded in action, 26-11-17, at Sitābaldi, S. of Nāgpur city; sketches of action at IO.[5]

BECHER, Robert. Ben. Inf.
b. India, Jan. 1791. d. 30-5-41, Canton, China.

Ens. 26-7-06 ... Maj. 9-3-37.
Son of Richd. Becher, BCS., salt agent, Tamluk, Midnapore.
m., Elizabeth —; his dau. Charlotte m. Augustus Abbott, Ben. Art.
Hodson, I (1, 117).
14-11-17, appd. to Nāgpur Subsy. Force; 24-10-18, appd. DAQMG. [337]; later DQMG.
BGO., 26-8-20, from Hoshangābād to Ganges-Jumna *doāb*, for road svy.; MRIO. 27 (15); *Ben Regr.* (156/37), 1820-1, road svys. Allahābād and to Nāgpur [27, 87].

BEDFORD, James. Ben. Inf.
bapt. 8-3-1788. d. 31-3-71, aged 83.

Ens. 29-3-10 ... Bt. Maj. 28-6-38; ret. 11-1-43; Hon. Lt Col. 28-11-54.
Son of John Bedford, of Acton, Middlesex.
m., Meerut, 20-9-23, Jane Helen, dau. of John Troup, of Nairn, and sister of Colin Troup, Ben. Inf.; she d., Allahābād, 18-9-36, aged 26.
Hodson, I (121).
Arrd. India by ship *Marquis Wellesley*, 25-9-09.
Dec. 1814, Medal of Merit at Ft. Wm. Coll., for Hindustāni and Persian.
1821, with 24th NI. at Morādābād, emp. at request of Magte. "in making certain small surveys" [332][6];

[1] name wrongly recorded as "Clive" by Blunt (71). [2] DDn. 145 (571-4), 19-11-19; 154 (66), 30-1-19. [3] pls. 17, 18. [4] DDn. 146 (15), 31-12-16. [5] Foster (51/207-8). [6] DDn. 196 (143), 6-11-21.

27-11-21, appd. Asst. Rev. Survr., Morādābād, Rohilkhand; 19-12-22, promoted Rev. Survr. in ch. Sahaswān [152-4, 333, 364, 405-6].

Burmese War; Oct. 1824, to Assam as survr. with column advancing up Assam valley, with Wilcox as asst. [3, 52-3, 151, 181-2, 205, 333]; survd. Brahmaputra and Luhit to Brahmakund, and Dihang to Pasial where the Abors turned him back, without his suspecting it to be the main river [54-6, 59, 63]; also survd. short way up the Dibang[1] [pl. 7, Dibong].

On active mil. operations on Noa Dihing, at capture of stockades, Neufville, the intelligence officer, writing, 15-6-25, "Captain Bedford, of the Survey Department, who accompanied us throughout as a volunteer, gave me the benefit of his experience and personal assistance on every occasion". On a later trip up the Dihing was much troubled with fever; "For the three following days I endeavoured, by reduced living and exercise, to overcome what I then considered a trifling illness, but after carrying my survey as far as the Kusan Pass, I found myself so seriously unwell, that without further delay I put myself under medical care"[2].

His journals and fdbks. are full and detailed, with neat sketches and cross-sections of rivers[3].

Closing work in Assam during the rains of 1826, returned to Calcutta, 6-9-26; lost much of his kit by the sinking of a boat, but retrieved a telescope and a sextant. After four months leave resumed ch. of rev. svy. at Sahaswan Jan. 1827, [160-1, 165, 217, 394]. Encouraged employment of Indian survrs. [389-90].

1832-43, DSG. in ch. Rev. Svys. and, from 1838, SGO. Calcutta [124 n.3].

BEDINGFIELD, Richard Gurdon. Ben. Art.
b. 5-9-02. d., Nongkhlao, Assam, 4-4-29, murdered by Khāsis; MI.

2/Lt. 8-4-19; Lieut. 13-6-20.

Son of Francis Philip Bedingfield, of Cumberland, and Catherine his wife, dau. of Thos. Havers, of Norfolk.

ed. Addiscombe, 1818-9.

Hodson, I (121); *Ben. Ob.* (375).

With Burlton [427], in comd. of "two howitzers and two 12-pr. carronades", joined force advancing on Rangpur, capital of Assam, Jan. 1825. Emp. on intelligence duty, attracting attention of Scott, who welcomed his meast. of discharge of river at Goālpāra [53], and describes him as "a good surveyor and excellent draughtsman" who would like to be employed on exploration[4].

Compiled from Burmese infn. a map of Chindwin R.[5] [54, 78-9].

On svy. in Darrang, Wilcox writing, 28-8-27, "Bedingfield ...will give you in a short period of time an excellent map of Camroop. He has already surveyed under favorable circumstances the NW. boundary of Durrung, ... and he is clever enough to take advantage of every means to improve his survey. I do not know that I should offend him by calling him *in some measure* a pupil of mine; but this a very qualified praise" [63-4].

Route Goālpāra to Gauhāti; Maps of Assam Rivers; MRIO. 36 (37); 173 (28). In ch. rev. svy. under Scott [146, 349, 484, 501].

April 1829, took leave with Burlton to Nongkhlao, in Khāsi Hills, on road Gauhāti to Cherrapunji, where they were "both barbarously murdered, ... the former [Bedingfield] on the 4th and the latter on the 5th inst. Both had gone there for the benefit of their health. Four or five hundred Kooseahs and Garrows surrounded the house, and poor Bedingfield went out amongst them unarmed to see what they wanted. They immediately siezed him, and after tying his hands behind his back and cutting the tendons of his legs, commenced shooting at him with their arrows. It is said that he told them, if it was his life they wanted, to kill him outright at once, which they accordingly did and, cutting off his head, placed it on a rock where a house formerly stood" [448].

Burlton and a companion were killed the following day after making a gallant defence[6] [64, 431].

BELLEW, Henry Walter. Ben. Inf.
bapt. 2-1-03. kd. in action, 13-1-42, on retreat from Kābul.

Ens. 16-11-19 ... Bt. Maj. 23-11-41.

Son of Robt. Bellew, barr., and Sarah Fowke his wife; bro. to F. J. Bellew, Ben. Inf.

m. Agra, 17-8-31, Anne, dau. of Capt. Peter Jeremie, Ben. Inf.; Hodson, II (553).

Hodson, I (127); Boileau (294).

Survd. route Ajmer to Jaisalmer [87]; 18-4-29, appd. DAQMG.

1829, Bde. Maj. Rājputāna Fd. Force; 1834, Shekhāwati expn.; 1839-42, Afghān War, QMG.'s Dept.

Auth. of *The Memoirs of a Griffin*, with sketches.

BENBOW, Clifton. Bo. Inf.
b. 1-10-1798. d. 19-8-81.

Lieut. 15-1-20 ... Lt Col. 9-7-49; ret. 4-5-50; Hon. Col. 28-11-54.

Son of John Benbow, MP., attorney, Lincoln's Inn.

ed. Westminster; adm. Lincoln's Inn, 15-8-15; scholar of Caius Coll. Camb., 1816-9.

Oriental Club.; *OW.* I (72).

1-3-24, appd. to Deccan Svy. [126]; 14-10-25, promoted to 1st cl. Survr.; Oct. 1827, arrd. England on mc.

1835-8, with Boyd on svy. of N. Kāthiāwār[7] [426].

BILLAMORE, Frederick Hadow. Bo. Inf.
b. Bombay, 26-6-1799. d. 20-8-35, Harsol, Gujarāt.

Lieut. 9-10-19 ... Capt. 9-4-31.

Son of Capt. Robt. Billamore, Bo. Mar., and Catharine Pruen his wife, pr. sister-in-law of W. A. Tate [II, 445]; bro. of T. R. B., Bo. Inf., who d., Karāchi, 27-4-40, and of R. A. B., Bo. Inf., who d., Jālna, 7-5-18, of sunstroke.

Left widow, Catharine, who drew pension on Lord Clive's fund, and d. 1875 aged 77.

Bo GO. 18-2-26, appd. asst. to Rev. Survr., Bombay & Salsette [168 n.2] serving till close of svy. 1827.

BIRCH, Frederick William. Ben. Inf.
b. Calcutta, 1-4-04. d. Sitāpur, Oudh, 3-6-57, kd. by mutineers.

Ens. 7-1-21 ... Bt. Lt Col. 20-6-54.

Son of R. C. Birch, BCS., pymr., Bengal, and Frances Jane his wife.

m., Lucknow, 7-7-25, Miss Jean Walker.

Hodson, I (143).

Burmese War, Arakan, 1824-6; having knowledge of svy., and possessing insts., was put on svy. of creeks S. of Akyab, March & April 1826; resd. owing to ill-health [69-70][8].

[1] *As R.* XVII (331-40). [2] to SG. from Sadiya, 19-2-26. [3] MRIO. M 452-3. [4] DDn. 230, M 414, 13-9-25, 11-3-26. [5] *As R.* XVII (325). [6] *Ben. Ob.* (375). [7] *As J.* XIX, 1836; *As Int.* (41); Map, MRIO. 123 (19). [8] DDn. 213 (112).

BLACKER, St. John. Mad. Cav.
b. 26-1-1785. d. 1842.

Corn. 29-9-01 ... Maj. 20-10-23; furl. 1825; ret. 2-1-28.

Son of Rev. Dr. St. John Blacker, rector of Moira, co. Down; bro. to Valentine [*inf*].

m., 20-12-26, Anne Hammond, dau. of Sir Chas. Morgan, MD. of Dublin.

1810-2, with Harford Jones' mission to Persia; 1814-5, Asst. Resdt. at Cochin; 1815, deputed to purchase horses in Persian Gulf.

Marātha War, 1818, comdg. irregular cav. with Sindhia [85, 383]; MRIO. 40 (3), "Routes marched by Sindia's Contingent". Emp. Wm. Sundt [382–3, 387] on svy. in Central India. Claimed that he had in his "possession the whole of the survey of the Madras army between the Nurbudda and Godavery, as well as their surveys during the late campaign, and of a former one in 1810–11 north of the former river [II, 134], together with Captain Tod's map of the interior of Hindoostan [II, 55–6], and...almost every information of this part of India".

Asks that he may "add to the stock I have acquired by employing the person I have mentioned...in filling up those vacancies in our knowledge of this country. ... I have every instrument required in surveying but a perambulator[1]."

10-8-18, appd. 2nd Asst. to Resdt. with Sindhia; 31-12-22, promoted 1st Asst.

BLACKER, Valentine [II, 382]. Mad. Cav.
b. 19-10-1778. d. Calcutta 4-3-26.
MI. S. Park St. cem.

Corn. 29-8-1798 ... Lt Col. 20-10-23.

SG. of India 1823-6 [2, 8, 300–1, 308–9].

bro. to St. John [*sup*].

m., Madras, 22-12-13, Miss Emma Johnston, and had three sons and a dau.

CB. 1818.

DNB.; *DIB.*; *EIMC.* I (323). Portrait in possession of family [pl. 20][2].

1803-6, AQMG. and Capt. of Guides [II, 313]; 1806-10, DQMG. Madras; 1810-19, QMG. Madras [II, 275 n.8; III, 98, 108].

Served through operations against *pindāris*, and Marātha War of 1817-8, being mentioned several times for distinguished services [338, 437]. Obtained Govt. permission to pub. account of the war, "having arranged the late field correspondence in the Department of the Quarter Master General, with a view to the preparation of a 'Precis' of the military operations in Malwa and the Deckan". ...

"I have likewise in my possession materials for preparing maps of the seat of the War, explanatory of the movements of the several corps, ... and topographical plans of the several field actions and sieges. ... These details...might contribute to the benefit of the service by the mere promulgation of military information, and...I beg...to ascertain whether any objection will exist to the proposed use being made of the official records in my possession. ... No former war so much merited...detail of events"[3].

Neither Hodgson nor Montgomerie seemed aware that Blacker had thus obtained full authority for the pubn. of his maps [291].

His book was pub. 1821, entitled "*Memoir of the operations of the British Army in India during the Mahratta War of 1817, 1818 and 1819,* by Lieut. Colonel Valentine Blacker, CB. and QMG. of Madras Army"; pref. sd. Madras, 13-3-20[4] [86, 289, 291–2].

Riddell writes from Madras, 14-5-18; "Blacker & Morrison are coming overland from Poonah by way of Beejapore [498]. The former intends to complete from routes &c., a map of the theatre of the late war". From Madras he sailed for Calcutta, 30-4-19, with the C-in-C., Sir Thomas Hislop [83, 316], and spent several months there on the Prize Committee, besides superintending the preparations of his maps, and the script of his History [86]. 24-7-19, back at Madras, read address from inhabitants of Madras to Lord Hastings[5]. 6-7-20, relieved from Prize Com.

9-1-21, Leave to Europe on mc.; spent much time on the continent, "my medical adviser having strongly urged me to pass the present winter in the mild climate of the south" [298]. At Florence in Dec. 1822 when he received letter from the Directors announcing his selection to be SG. of India, and hoping that he would proceed to India in the spring[6]. Though given extension of leave on med. grounds, further extension to Sept. refused. Everest writes in May 1823; "Received intelligence a short time ago that Col. Blacker was very ill in France, and that he was not expected out before the end of the present year"[7] [446].

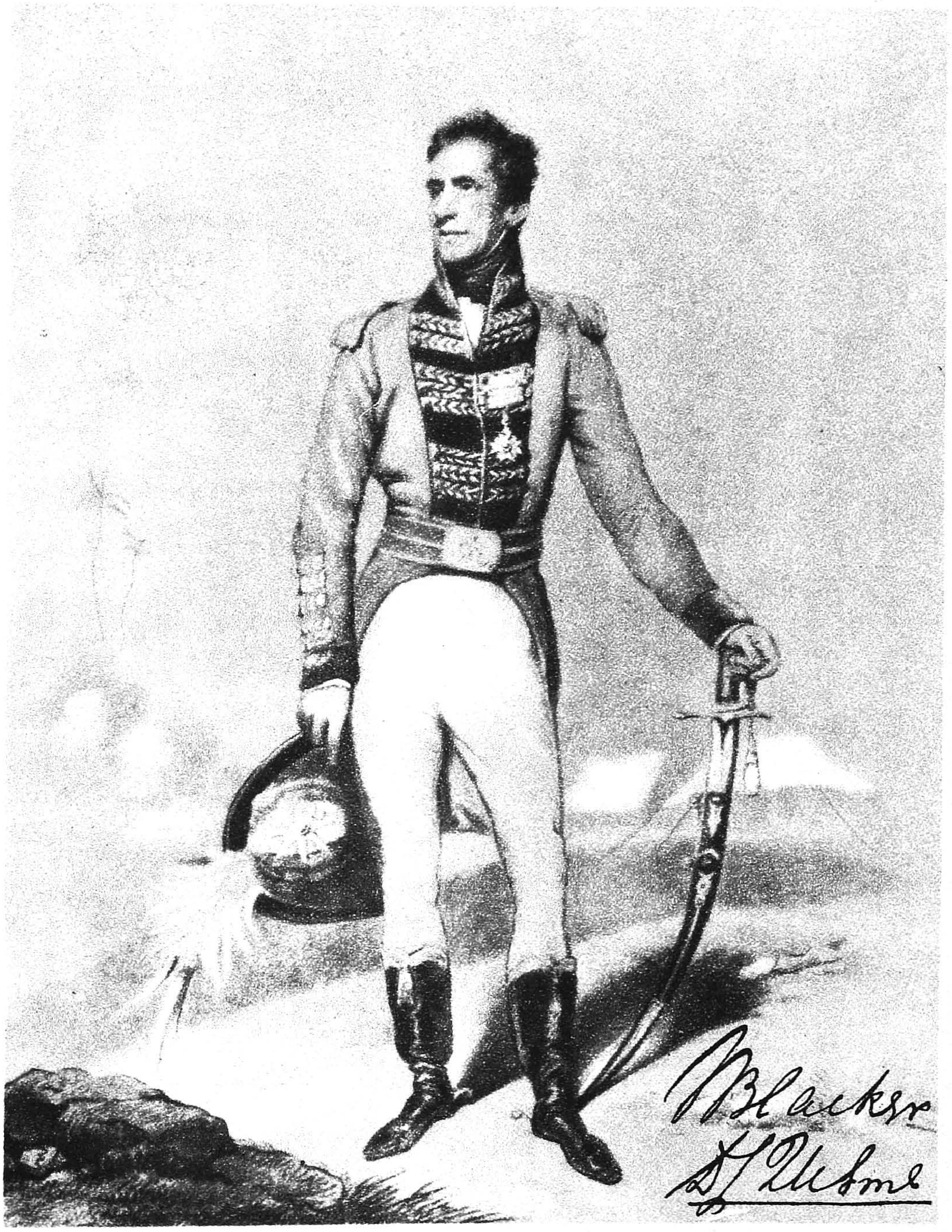
Leaving England in June, Blacker arrd. Calcutta 21-10-23, and took over charge of dept. on 24th [461]. Though not by training a scientist, mathn., or astronomer, he took a keen interest in everything that touched his new profession as surveyor and map-maker [55, 71, 90, 118, 185, 187–8, 191, 261, 323, 330, 345, 381, 442, 455, 485, 492, 496].

Sept. 1825, elected member of ASB.[8] at Calcutta, and later read paper on barometers and hygrometers. Took a strong line on importance of GTS. as the only possible foundation for the surveys and maps of India, his letter of 11-8-24 stating the case in terms that were beyond challenge. Waugh writes 25 years later; "The Honourable Court of Directors having called for a report on the...probable duration of the trigonometrical survey, a very masterly discussion of the subject was prepared by the late Colonel Valentine Blacker, ... who, with the exception of Colonel Everest, was the ablest and most scientific man that ever presided over this expensive department"[9] [240–2, 263, 296, 445, 452, 455].

Fully maintained Mackenzie's insistence of one uniform system for Indian maps and surveys, more especially with regard to new ¼-inch Atlas [4, 120–1, 194–5, 282, 297–8, 305], for which he worked out lay-out and projection adapted from the French [283–4, 293–5, 457].

Continuous residence in Calcutta told on his health. He writes in Jan. 1824 that, "being severely afflicted with the rheumatism" he was obliged to "use the pen of another"; and again in June; "I am positively prohibited from stirring out while the sun is up". Died on 4th March 1826 at the early age of 48. Though there have been various conjectures as to cause of his death, none of the Calcutta newspapers are more precise than the *Asiatic Journal*; "Colonel Blacker died on Saturday last after a short illness. Beyond the line of his duty, in which his high character raised him to the appointment of Surveyor General of India, Colonel Blacker is known chiefly by his account of the late Mahratta War, in which work military operations are delineated with a degree of spirit and precision that...has rarely, if ever, been surpassed. The early period of his residence in Calcutta was engrossed by official demands upon his time, but of late he had found leisure to engage in both philosophical and literary inquiries...connected with his profession"[10] [205, 273].

[1] DDn. 144 (379–83), 7-4-18. [2] cf. S *of I. GR.* 1925–6. [3] from Blacker, 8-10-18; MMC. 24-11-18. [4] Blacker. [5] *As J.* IX, 1820 (74). [6] Misc. LR. 149/315, 12-2-22. [7] to Hodgson, DDn. 171 (14) 21-5-23. [8] *As J.* Aug. 1826 (193). [9] *PR.* (5). [10] *Govt. Gaz.*, 7-3-26.



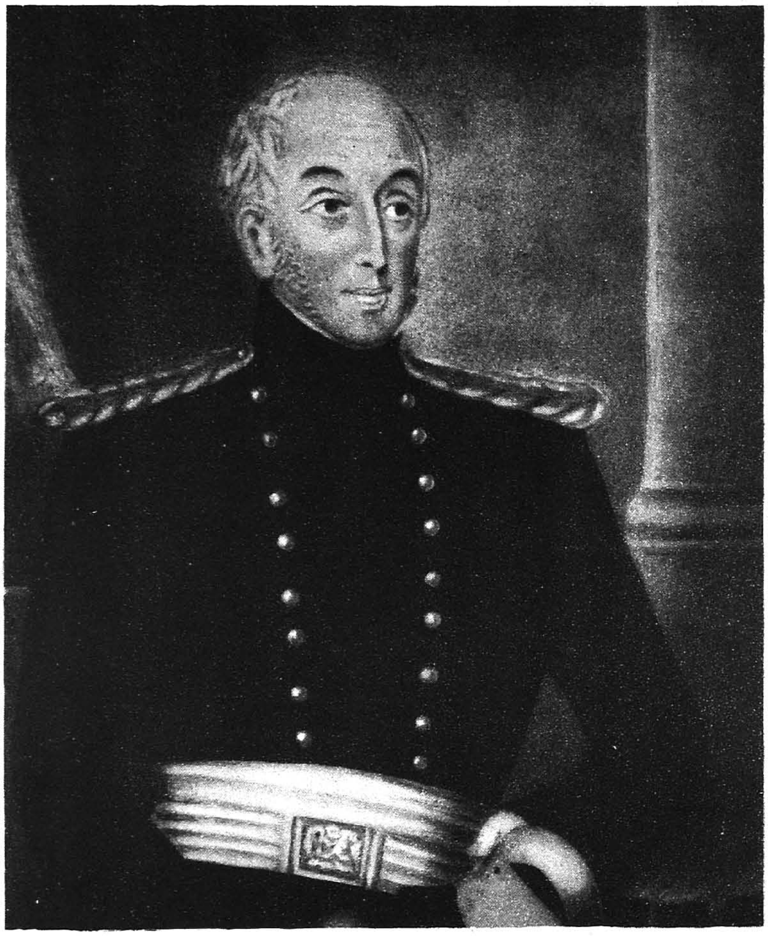
VALENTINE BLACKER (1778–1826)

Madras Cavalry. Quartermaster General, Madras, 1810–20; CB.; distinguished service in Marātha War, 1816–8; wrote a vivid account of the campaign, and produced important maps of central India, which led to his appointment as Surveyor General in 1823 (86, 300-1).

Died after a short illness in Calcutta [II, 382].

From a portrait in the possession of his family.

Printed at the Survey of India Offices (H.L. O.)
Reg. No. 4855 HD'50-800'52.



JOHN ANTHONY HODGSON (1777–1848)

Bengal Infantry. A keen practical surveyor, and enthusiastic astronomer, his most important survey being that of Sirmūr and Garhwāl, 1816–8 [30–6].

As Surveyor General of India, 1821–3, initiated revenue surveys of Upper Provinces, holding charge of them as Revenue Surveyor General from 1823 [305–6]. Again Surveyor General of India 1826, resigning on account of ill-health [300–1].

On return to India held several military commands, till his death as Major General at Ambāla 1848 [II, 407–8].

From a portrait in the possession of his family.

Reg. No. 4856 HD '50–800'52.

Printed at the Survey of India Offices (H.L. O.

Edw. Alexander, who arrd. Calcutta from Burma 26-1-26, writes; "Among other friends here I visited the late Surveyor General of India, Colonel Blacker, whose recent death has been so severe a loss to science in India. His health was then far from being good, but he continued indefatigably employed in his literary labours"[1].

Everest writes several years later; "Colonel Blacker fell a victim to fever contracted, as it is supposed, from the noisome vapours generated by the cleaning of an old tank in the grounds attached to the Surveyor General's office in Park Street, Chaoringi [311]"[2].

Amongst papers which Blacker wrote for ASB. was one read 2-11-25, "*The Geographical Boundaries of India.* ... The author has incontestably made out that the river Indus cannot be considered either geographically or politically as the western barrier of Hindoostan"[3].

Another paper, *The Military Geography of Central Asia*, is preserved as *IO. Tract* 300.

Portrait given on pl. 20 is copied from one at Carrickblacker, co. Armagh. The original of the map which Arrowsmith reproduced for his *Memoir of the Mahratta War* is preserved by the family at Elm Park, co. Armagh[4].

BLACKWELL, Thomas Eden. HM. 13th Foot (later, Somerset LI).

Ens. 25/6-12-22 ... Lieut. 21-7-25; shewn in *AL.* 1828, omitted 1831.

1824, with regt. at Ft. Wm.; Dec., wounded twice at Rangoon. Nov. 1825, with Grant as asst. survr. [72].

BLAKE, Benjamin [II, 382]. b. 6-8-1788. d. 12-3-38, in Egypt, *en route* to England.

Ens. 17-9-06 ... Bt. Maj. 10-1-37.

Son of George and Ann Blake of Portsmouth.

m., c 1806, Elizabeth Lidington.

Hodson, I (162); II (622).

1808-14, on svys. in Upper *Doāb* and Gorakhpur [457]; BGO. 15-11-16, furl. to England.

BGO. 8-2-22, appd., with allces. of River Survr. [138-9], to svy. Salt Agencies of Bhulua (Noākhāli) and Chittagong [493]. Lost a boat full of kit in storm at mouth of Meghna, 27-3-22; BGO. 5-10-24 reverted to mil. service [333]. July 1825 to Jan. 1826, at Barrackpore.

DDn. 252 (2), 17-1-26, offered survg. insts. to SG. on sale; "my finances are very low to meet the expense attendant on a voyage to England for the recovery of my health, which has been injured by long experience on surveying duties".

BLAKE, William. Ben. Inf. b. 24-6-1780. d. Benares, 23-9-21.

Ens. 7-10-1799 ... Maj. 5-5-21.

Son of Benjamin Blake and father of Muirson Trower Blake (1809-57), Ben. Inf., asst. survr., Bhutān, 1836.

m., in England, 1807, Mary Anne Wolsey, dau. of Col. B. Wolsey Muirson.

Hodson, I (164); III (745).

BGO. 2-5-17, to svy. and mark out line of road Benares to Sahāranpur, under orders of Supt. Police, W. Provinces.

BLANDFORD, Morgan Dove. Survr. uncov. b. Jan. 1790. d. Calcutta, 27-10-35.

Arrd. India 1810, and emp. with Messrs. Joseph Taylor & Co., auctioneers, Calcutta.

m., Calcutta, 27-6-12, Elizabeth, b., Calcutta, 5-11-1795, dau. of John. Watts, gunner, and Ann his wife. Elizabeth d. Calcutta, 11-8-13, after fall from buggy 7-8-13, leaving dau. Mary Ann, b. 10-4-13. He had children, b. Monghyr 1829 and Calcutta 1834, by a 2nd wife, Elizabeth Workman.

18-7-17, appd. asst. survr. & dmn. to Alex. Gerard, survr. to Bd. of Comnrs., Sahāranpur, @ Rs. 200 pm.; disch. 1-2-19, on close of svy. [218, 347]. Fair copied several of Gerard's maps, including that of Dehra Dūn which bears his autograph [22-3, 202 n.4, 451 ; pl. 3].

1825-31, Indigo planter, Tirhut; 1832, merch., Patna; 1832-4, oil merch. and "assistant builder", Wellesley Sq., Calcutta.

BRC. 22-1-35 (26), emp. by Rev. Bd. on svy. of swamps and *bhils* nr. Barasat, 24-Parganas, and d. of fever a few months later [367].

BLECHYNDEN, James. Survr. uncov. b. 1797/8. d. Calcutta 16-3-37.

Son of Richard Blechynden, who arrd. India 1784 and practiced as civ. architect & survr., and later Supdt. of Roads, Calcutta. Richard d. 4-2-22, and Hodgson reports in April that "at the sale of the effects...I took it upon me to purchase a very good plane table and some other small articles required in the village surveys"[5].

James appears to have had a bro. Thomas, d. Calcutta 24-5-45, aged 44; MI. N. Park St. cem.

In applying for empt. 1823, James records that "I was nominated to succeed Captn. [Hugh] Morrieson in the Sunderbunds Survey on his being called to join his corps during the Nepaul War [II, 432 ; III, 12]. ... Subsequently I was appointed Head Surveyor of Calcutta & the 24-Pergunnahs in the office of the Collector [136]. ... On the abolition of the situation, was recommended by the late Lt. Col. Mackenzie to accompany & assist Lt. R. Wroughton in his survey of the Mattabangah & other rivers and shoals, &c. [15], and also to perform various other duties, ... such as drafting Lt. Coll. Blacker's maps, plans, &c., for his 'Memoirs of the Mahratta Campaign, &c.' [282, 424], and lastly that I was...Surveyor of Embankments & Superintendent of the Revetments in Cuttack...nearly 3 years. ... This appointment has been since abolished. ...

"I have always, with the exception of 3 months in the Collector's office, received Rs. 300 per mensem, and had an establishment allowed me. ... At Cuttack I drew a personal salary of 300 Rs. per mensem, and a monthly establishment allowance of 62 Rs., and was allowed in addition to the above 1 rupee 1 anna per mile for travelling charges"[6].

m., Calcutta, 20-7-20, Sarah Radfield, nat. dau. of Richmond Thackeray, father of novelist; she d. 25-5-41 aged 35; MI. N. Park St. cem., Calcutta.

March 1817, Survr. under Collr., 24 Parganas, examined by Hyde, ASG., and passed as qualified Land-Surveyor[7].

pr. 1823, ran levels for lay-out of Calcutta canals[8] [14].

9-10-23, appd. asst. survr., to join Fisher in Sylhet [145, 333, 369]. April 1824, with Scott across Khāsi Hills to Gauhāti [51, 501]. On rev. svys. under Scott in Assam valley.

Possibly asst. in Acct. Gen.'s office 1832; *B Dir & AR.* 1833 (454).

Under CD. to B. 27-7-36 (45-7), granted pension, his claim being "founded on services of sixteen years, employed principally in land surveying. Your Government being precluded from granting pensions to uncovenanted servants under a service of twenty years, Mr. Blechynden has memorialized us. ... In consideration of his destitute condition and loss of health, ... caused principally by repeated returns of jungle fever originally caught in Assam, we shall not object to you allowing Mr. Blechynden one third of the salary he received in his capacity of Superintendent of Embankments in the 24 Pargannahs (Rs. 200 per month), under the Commissioner of Alipore".

[1] Alexander (54). Jas. Edw. Alexander, Lieut. HM. 13 Lt. Dragoons; FRGS.; in Burma 1825-6; with Macdonald in Persia, 1826-7 [II, 419]; *As J.* XXIII, Jan.-June, 1827 (649). [2] Everest (128). [3] *Govt. Gaz.* 10-11-25. [4] Maj. L. V. S. Blacker, who led the Houston flight over Mt. Everest, 1933, is descended from Latham B. 1st cous. of Valentine. [5] from SG. 10-4-22, BTC. 22-4-22 (52). [6] BTC. 9-10-23 (24). [7] B Rev. Bd. 18-3-17. (9-10). [8] *Ben. Sel., Canals* (5).

BOILEAU, Alexander Henry Edmonstone. Ben. Engrs.
b. Calcutta, 3-2-07. d., Cawnpore, 30-6-62, of dysentery.

2/Lt. 17-6-24 ... M Gen. 18-10-60.

Son of Thomas Boileau, notary-public, Calcutta, and Leah his wife, dau. of Lt Col. Ebenezer Jessop of Albany, New York; bro. to John Theophilus Boileau, Ben. Engrs., who was stationed at Agra in 1828.

m., 1st., Agra, 3-2-34, Charlotte, dau. of Wm. Hanson; she d., Barrackpore, 29-4-40, aged 26.

m., 2nd, Paignton, Devon, 5-9-50, Matilda Grace, dau. of Alex. Tovey, HM. 20th Foot; she m., 2nd, Lt Gen. A. T. Cadell, Mad. Art.

ed. Addiscombe, 1823-4.

Hodson, I (171); III (746). Colesworthy Grant; portrait in undress uniform, with inst. & tripod, from *India Review* of June 1840 [vol. IV].

2-7-25, posted to S & M., Cawnpore; 1825-6, at siege & capture of Bharatpur.

24-2-27; writes to SG. from camp near Allahābād, "should my services be at all available in the department under your charge, I shall be happy to apply them...wherever they may be most useful. ... I am...acquainted with the localities of the Doab and the country immediately west of the Jumna, towards Deig and Ferozepoor[1]. ...

"I have in my possession a set of plans, reduced from surveys on a larger scale by myself and other officers of Engineers, comprising the whole of the forts lately captured or surrendered in the Bhurtpoor Territory, which I had intended to lithograph for the use of the Corps"[2].

On evidence of his svy. ability from brother officers, SG. obtained his appt. to svy., Oct. 1827 to April 1828, from Allahābād to Cawnpore [3, 24-6, 190, 202-3, 330], and, Oct. 1828, from Agra to Bharatpur [26-7, 189, 203, 220][3].

His work was good and won Hodgson's approval. From 1832 to 1838 served with GTS. He then had successful career on engr. duties.

1828, made measts. of the Tāj at Hodgson's request, "As soon as you arrive at Agra, at your first leisure, ... make me a very exact measurement in feet and inches of the 4 sides of the marble platform on which the Taj stands. ... Pray ask Capt. C— in my name to lend you the chain belonging to the Trigonometrical Survey, and having made the measurements return it to him [241, 246, 250]. I made some measurements of 2 sides of this platform when I was at Agra, but I wished to have the 4; it is very nearly an exact square. The proper measure will, I think, be where the vertical from the wall cuts the horizontal line of the platform, but it may be as well also to take the interior measure within the low balustrade which surrounds the platform, and also the distance from the outer edge of the corner"[4].

Boileau suggested that S & M. might help on his svy.; "As expert workmen the sappers would be very useful in clearing ground for the base, in erecting signals, etc., and I am sure, from having served about two years with them, ... that they are ready to turn their hands to almost any kind of work"[5]. A small dett. under Lawrence Hill joined him in 1830 for a few months.

BOILEAU, John Peter. Ben. Inf.
bapt. 10-1-1790. d. unm., Patna, 1-12-18.

Ens. 2-10-05 ... Lieut. 26-10-05.

Son of John Theophilus Boileau of Dublin; cousin to A. H. E. [*sup*], and John Peter Boileau, Ben. Horse Art., whose sister m. Samuel Davis (I, 332).

Hodson, I (173); II (623).

BGO. 7-2-14, appd. to comd. Maj. Bradshaw's escort in room of Pickersgill [II, 436-7], Bradshaw reporting on an action near Nepāl border, 25-11-14, "Lieutenant Boileau, commanding my escort, ... received a deep sabre cut in a personal contest with a Nepalese Soobah whom he slew, and whose death hastened the success of the general attack"[6].

10-2-16, appd. Asst. to AGG., Gen. Ochterlony in pol. dept.; B Pol C. 16-3-16, appd. to comd. escort of Resdt. at Kātmandu, Nepāl, and to be Postmaster to Resdcy.

March 1817, survd. frontier between Nepāl and Tirhut; svy. occupied only 30 days, but protraction of 7 copies took 5 months. "Concluding the demarcation...engaged but a very limited time. I had to ...undertake it at a few days notice, and to incur a considerable expense in the purchase of instruments, and in the hire of the extra servants, ... and afterwards had to return unemployed...from Purnea to Nepāl, and then make the 7 copies for the different departments" [19-21][7]. He continued his svy. eastwards in 1818, and left his maps unfinished at his death.

BOLES, James. Mad. Inf.
b. 18-9-1789. d. Madras, 26-5-23.

Lieut. 29-9-06 ... Capt. 27-1-19.

Son of Thomas Boles.

MGO. 2-2-19, appd. Asst. Survr. under Comnr. of Poona for svy. in S. Marātha Deccan [125 n.6, 352]; Bo MC. 7-6-20, resd., to become Mil. Pymr., Ceded Dists., at Bellary.

BOYD, George. Bo. Inf.
b. Minorca, 2-8-1800. d. Rājkot, 24-8-50; MI.

Lieut. 4-5-20 ... Lt Col. 1-5-48.

Son of Ann Boyd, who m. 2nd, —— Smith.

ed. RMC. Sandhurst.

24-1-22, appd. asst. survr., Deccan Svy. [125 n.12, 126]; *IO Cat.* (446), 1823, svys. of Sātāra, N. of Mahābaleswar; 1828-9, assisted in meast. of Karli base-line [130]; 1830-1, in ch. Deccan Svy.

1832, with regt.; 1835, with Benbow [423] on svy. in Kāthiāwār; 1842; with Le Messurier on svy. between Quetta and Kalāt. 1839, with De l'Hoste on road svys. in Sind, submitting specimens of lead ore from Las Belas, *Bo Geo Soc.*, 1839-40 (204).

Foster (108); sketches and views of Bijāpur, Afghānistān, etc., 1836-42, preserved at IO.

BRIGGS, John. Mad. Inf.
bapt. Madapallam,[8] 19-12-1785. d. 27-4-75.

Lieut. 20-7-01 ... Col. 1-12-29; furl. 1835, ret. as M Gen. 1838.

Son of Dr. James Briggs, Surg. Gen., Madras.

FRS.; *FRAS.*

DNB.; *DIB.*; *Briggs*; *Oriental Club*; VM. exbt. 1012, portrait by J. Stewart, 1839.

On voyage to India, "I kept up my nautical knowledge and practice, especially the use of the sextant, which was most useful to me afterwards in several surveys on land that I was enabled thereby to undertake". After course with Cadet Co. at Chingleput, joined 15th NI. at Cumbum[9] in Ceded Dists[10].

1809-11, with Malcolm to Persia [II, 173-5]; name carved on Persepolis gateway [II, 445].

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[1] both in Bharatpur. [2] MRIO. M 348. [3] sent 60 rough maps, fdbks., and traverses to DSG. 18-10-45, DDn. 415 (15-8). [4] DDn. 220 (331), 14-5-28. [5] Boileau's fdbk., DDn. 227, M 314; 10-2-29. [6] *Nepaul Papers* (181). [7] DDn. 133 (17), Jan. 1818. [8] Suburb of Narsapur, formerly important EIC. Factory. W. of Chicacole; *Imp. Gaz.* XVI (227-8). [9] II, pl. 16; III, pl. 18, Cummum. [10] *Briggs* (11).

Persian scholar, spent several years on tr. from Persian of *History of...Mahomedan Power in India, till the Year A.D. 1812*[1], writing in pref. "Before the end of the year 1815 I had...completed the translation of the whole work with copious notes. The war which broke out in India in 1817 rendered it necessary for me to accompany the army that marched to Malwa. I left my library and manuscripts at Poona, with the exception of the translation of Ferishta, which had been sent to...Bombay.

"On the 5th of November 1817, the Peshwa attacked the Poona residency, ... and after sacking the place the troops set fire to the houses, and burned them *with their contents* [125 n.4]. My own family had the good fortune to escape with their lives, but the whole of my property, ... including my library together with my manuscripts, ... was lost or destroyed[2]".

BGO. 6-1-16, appd. 3rd Asst. to Resdt. at Poona; with Malcolm's column in pursuit of Peshwa.

May 1818, assumed ch. of Khāndesh; "The Army of the Deccan was broken up. ... General Hislop delivered over to the charge of Briggs all the forts and dependencies ceded by Holkar, and conquered from the Peshwa, north of the Godavery as far as the Satpura mountains, and Briggs came under the orders of Mountstuart Elphinstone, sole Commissioner of the Deccan. The tract contained about 19,000 square miles, comprising...the valley of the Godavery, a well populated region, and Khāndesh, scantily inhabited"[3].

By 1822, with some assistance, Briggs completed svy. of his whole area, with valuable map which though by no means precise was best available thirty years later [123–4, 383]. A reduced copy was lithd. scale 4 miles to an inch.

1823, Resdt. at Satāra; senr. member of Mysore Admn. Bd.; 1832–5, Resdt. Nāgpur.

Auth. of *Letters addressed to a young person in India, London*, 1828.

BROWN, William. Ben. Inf.
b. 22-12-1795. d. unm. 11-9-45, on mil. service Sukkur, Sind.

Ens. 5-6-15 ... Bt Maj. 23-11-41.

Son of Andrew Brown, writer, co. Ayr.

Hodson, I (228).

23-11-22, appd. Asst. Rev. Survr., Delhi [151, 156, 332–3]; 17-11-26, Rev. Survr. Sahāranpur [154, 156–8, 162–3, 366, 411–2]; 1829 to Bulandshahr. Led empt. Indian survrs. [389–90]; investigated length of *koss* [164–5; pl. 15].

On Rev. Svy. till 1844 [490]; probably the most capable of all the rev. survrs. in Upper Provinces, 1822–1842 [pl. 24 n.2].

BROWNE, Birnie. Ben. Art.
b. 22-9-1796. d. Peshāwar, 30-10-55.

Fwkr. 14-8-17 ... Bt. Col. 28-11-54.

Son of Birnie Browne of Leith, wine-merchant, and Catherine Grace his wife, dau. of John Creswell, of Northumberland.

m., St. John's, Calcutta, 2-8-26, Miss Maria Jane Christiana.

ed. Addiscombe, 1812-5. Hodson, I (229).

1818-22, PWI. Penang.

22-11-22, appd. Rev. Survr. of N. Div., Morādābād [154, 333]; Oct. 1824, Burmese War, to mil. duty to Cāchār [65, 151]; survd. Barāk R. with Pemberton as asst. [494]; 19-8-25, to Burma, arriving Rangoon 20th Oct.

With Macan survd. Irrawaddy up to Pagan [72–3, 370, 474]. Grant reported from Prome, 3-1-26, "Lieutenant Browne has...had of late very bad health. I doubt whether he will have an opportunity of joining the army. I shall...enquire whether the General will be disposed to assist him in getting up to Tongoo, should *it* be his wish to make the attempt"[4].

The Toungoo trip was not possible, but after signature of peace, Browne and Macan survd. route across the Arakan Yomas from Padaungmyo to Taungup [3, 73]; he later reported to the SG. "that at the time I was ordered from Prome I was necessitated *to abandon my baggage*, taking with me only a few things. The suddenness of my departure was such that I left my property at Prome to the chance of finding its way to the Presidency, but all hopes of recovery are now at an end"[5].

Leaving Calcutta by river, 1-12-27 [490], Browne rejoined rev. svy. at Morādābād March 1827 [155], remaining in ch. for the next 15 years [pl. 24 n.3].

BURLTON, Philip Bowles. Ben. Art.
bapt. 18-12-03. kd. by Khāsis. Khāsi Hills, 5-4-29, nr. Nongkhlao.

2/Lt. 19-12-20; Lieut. 1-5-24.

Son of Wm. Burlton of Wykin Hall, Leics. & Ravenstock Ho. Wilts.

ed. Winchester; scholar 1815; Addiscombe, 1819-20.

As J. xxviii (594, 732); *Ben. Ob.* (375); *DIB.*; Hodson, I (252); III (751).

"Arrived in India at the end of 1821, and joined his regiment at Dum Dum. He and another subaltern were sent up country in disgrace for...inviting to the Mess the editor of a Calcutta journal, who was a *persona non grata* with the authorities for the outspoken way in which he criticised public policy in his journal. Burlton was sent to Assam, and on the outbreak of the Burmese war, was actively employed in the field, and mentioned in despatches. On the termination of hostilities he devoted himself to...discovering the sources of the Burrumpooter and Irrawaddy, and of solving several geographical questions"[6] [434].

Jan. 1825, with Bedingfield [423] in advance on Rangpur; survd. course of Brahmaputra to Sadiya, taking section above Gauhāti [3, 53–4]. Feb. 1826, up Dihang with Wilcox, who would have been "very glad to avail myself in any distant journey" of Burlton's "permanent assistance and society"[7]. In subsequent narrative Wilcox describes trip up Kharam R. s. of Brahmakund with Burlton [514];

"Here it was often found necessary to open a passage up a shallow by removing stones from the bottom. Our route while the boats remained with us was generally through the jungles on the bank, but a survey of sorts was made, estimating the distance by time, and taking what bearings the closeness of the jungle permitted. A perambulator would be battered to pieces, and the objection to a chain would be the necessity of wading across every two or three hundred yards, and the want of open ground"[8].

With Wilcox on second trip up Dihang at end of Dec. 1826, reaching Pasi village before being turned back by Abors. Wilcox now confirmed in belief that main stream of Tsang-po came down Dihang [56].

[1] pub. London, 1829, in 4 vols. [2] *Ferishta*, I (vii, viii). [3] *Briggs* (59). [4] DDn. 221 (135), 3-1-26. [5] DDn. 221 (183), 18-5-26. [6] *Ben Ob.* (375). [7] *v. CG.* 9-5-25; *As R.* XVII (317-9); DDn. 214, 25-2-26. [8] *As R.* XVII (345).

April 1827, they started adventurous expn. to Irrawaddy near Putao, from which they returned 16th June completely exhausted [60–2, 79]. Wilcox writes from Sadiya; "Burlton has had returns of his ague, but in the intervals of his fits he is well. He has kindly undertaken to write from our journals. ... I have written again respecting his services since he joined me. ... The annoyances...endured, with loss of health, ought to incline the Government to act more generously towards him than at present they seem inclined"[1] [349].

It is worth quoting further from Burlton's vivid account[2] [62; pl. 7];

April 15th. "Left Suddeyah. ... Took no servants with us, understanding from the Suddeeya people (who hold the physical powers of the Bengalese in great contempt) that ...they would either die on the road or be obliged to return".

Up the "Now Dihing" in small dhingies with light awnings which hardly protected them against "heavy rain, or gales of wind. One of the latter paid us a visit rather unexpectedly when we were comfortably asleep" and blew down their shelter. "We endeavoured to set it up again, but in vain. After shivering in the wind & rain for some time, with more the appearance of drowned rats than of Officers and Gentlemen, we gave it up, ... and rest there was none for the remainder of the night. We halted next day to dry the rice & every other thing we had with us". ...

"27th. We were amused by the sound of a bird which is a curiosity. ... For want of a better name it may be called the Bell Bird from the striking resemblance it makes to the sound of a bell tolling at a distance. On first hearing it we conceived it to be such. ... We had no opportunity of seeing it so a description cannot be given. ...

"29th. ... A spot was pointed out to us as much resorted to by deer & elephants for the white salt. ... Petroleum is also found there[3]. ...

"May 1st. ... The Bridge, or Sakoo, is a very simple one, ... and would answer remarkably well over any impassable river where expense would be a consideration. It consists of *two* strong canes being stretched across, on which is suspended a basket or cradle. The passenger sits in this & by means of another cane & by his own exertions he is pulled across in perfect safety.

"To a man unaccustomed to crossing, & subject to be giddy, the sensation may be rather unpleasant should he look down on the water roaring beneath him. ... The distance across the narrowest part...was about 80 yards, and from the opposite side a man was inaudible.

[Here follows sketch of bridge, river, and hills].

"Our ponies were unable to cross, and the elephant succeeded with much difficulty.

"At the small and inhospitable village of Pasheelah it was with some difficulty that we procured a fowl for our dinner, their excuse being the impossibility of catching one. A double barrelled gun was put in requisition and levelled at a fine "Dame Birtlett" [*sic*] with a brood of chickens. It had the desired effect—a fowl was presented immediately.

"2nd. Halted at Phogong. ... We met with much more attention at this place than at any of the other villages. ... The greater difficulties of our journey commence from this. We have before us the pleasant prospect of 12 days journey without the chance of seeing a village or a human being besides ourselves. Our coolies loaded with 12 seers[4] each, their own clothes, pots, &c., can carry little besides. Road or path there is none, the only persons who have travelled our intended route within the last two years being two Mishmees [60]. ...

"May 3rd. Started at 9 a.m. with an "heterogenous retinue...of Sing Pho's [54 n.2], Kampty's, Mishmees, Moolooks, Kamjauns, and Burmese, all speaking a different language. The Assamese (like the French in Europe) is the universal language amongst the rude tribes. ...

"After crossing to the right bank of the Dahing, our path was a very difficult one up the river's side, hopping and jumping from one large *boulder* to another, and...climbing up and slipping down steep cliffs of sandstone. We saw during the day thin strata of coal, ... also a sycamore tree and two rather curious caves in which the Mishmees beat about in the hope of getting bats for their dinner. ...

"We were here for the first time tormented by *Dam Dooms*, poisonous flies which bite more severely than musquitos. The fly is not known in Assam or India, & appears to confine itself to the Mismee & the adjacent mountainous country[5]. God forbid they should ever emigrate more westward, for as they make their attacks by day in thousands, they would prove a greater annoyance than any pest at present known in India. Their bite causes a blister which itches immoderately, & the unfortunate wretch who scratches gets a dreadful sore for his pains.

"5th. ... At 4 P.M. we came up with the Meechmees, & found them cooking their rice and sitting under the trunk of a tree which had fallen. Supposing that we had at last reached our halting place, we eagerly enquired for water. In reply they pointed to a hole in the side of the tree, ... and we then discovered that this "Diamond of the Mountain", this old trunk, contained all the water we were to expect that day. The tree is torn up from its roots & it does not appear how it could collect water, unless from drippings of rain. Yet we were told that as it is emptied it gradually fills again. It held about half a hogshead[6] of bad water".

[Here follows sketch of fallen tree].

"A number of our fowls had died, and we had only one for today's dinner. ... Our people, being knocked up & fatigued, did not arrive till very late; it was with much difficulty we could this day get a hut[7] built to shelter us from the rain, which continued all the evening.

"6th. ... The water in the tree scarcely sufficed for yesterday's dinner, & what remained in the morning was so small a quantity, & in so dirty a state, that we thought it advisable to march on till we reached better. After climbing over *one more* high peak, and round the side of another, we found a hollow...where water collected in small pools which sufficed for our morning's meal, after which (the Lord be praised) the Wanboo. ...

"We passed nothing particular in our descent excepting a buck & fig tree—the latter producing very fine fruit—& some fine scented violets. We enjoyed a view of a long range of snowy mountains at no great distance across the Dupha, & on reaching the bottom we entered to the right on a beautiful plain covered with short grass & fern, but of no great extent. ... Halted on the left bank of the Dupha, at spot frequented by hundreds of deer, elephants, and monkeys. Heavy rain. ...

"7th. ... The pass we surmounted is the termination of the left branch of the Dupha. It is said that the waters flowing to the west fall into the Dehing, those to the eastward into the Toonghau, which we found to be a river of considerable size. ... In the pass...Wilcox picked up what at first he conceived to be a curious specimen of quartz. It was the skull of some unfortunate wretch who must have died a miserable lingering death in the snow. ...

"Two of Burlton's men lay down on the road to-day, knocked up by fatigue & fever, and refused to move. To assist them was impossible; carry them we could not, even had we rice sufficient to enable people to bring them on. However melancholy such a circumstance, they *must* be left to their

[1] DDn. 214, 28-6-27. [2] DDn. 224 (20–52), 4-7-27. [3] about 50 m. E. of the modern oil-field at Digboi. [4] about 25 lbs. [5] common in Shan States; their bite leaves local irritation for several days. [6] 1 hogshead = 52½ gallons. [7] the *basha*, built of leaves; known so well to the 14th Army, 1943–5.

fate. ... Height of the Foonghan about 9,782 feet above Suddeeyah[1]. ...

"9th. Heavy rain all the morning. A halt would be most desirable, to allow the two unfortunate men to come up & to give rest to the whole party. Almost every man is knocked up; swelled feet & dreadful sores the general complaint, & several men with fevers. Our rice however will not allow of it. ... Leeches and *Dam Dooms* scarcely bearable; we once took the trouble to count the collections of about half an hour, and 35 leeches were torn from one leg! ...

"11th. Having a long march before us we started earlier than usual...& reached our halting place after a most fatiguing march at 4 P.M. The only people up with us were the guides & some of the Sing Pho's, who appear to stand hard work better than the rest. ... The remainder of our people did not arrive till late at night, and some not till next morning. ... We got a Sing Pho to cook us some rice which we ate with our hands &, drinking gin and water out of the pot cover we did very well. Heavy rain all the evening and all night. Since crossing the Foonghan we have been fortunate in procuring plantain leaves with which to build our hut. Wilcox (as well as the rest) has been much annoyed by a sore foot. ...

"13th. ... We left the Nam Suee[2] at its junction with the Namlong, which we found to be a river 30 & 40 yards wide, apparently navigable for dingys. We marched a short distance over the boulders, & occasionally knee-deep in the water. Afterwards ascended to a path thro' the jungle, more abundant in leeches than any place hitherto seen. It is astonishing that the profuse bleeding they cause does not reduce the swollen feet of our people. All are more or less affected [caused chiefly by the Dam Doom bites], but some look as if they had elephantiasis. ...

"Burlton was siezed with a fever on today's march which stuck to him 3 hours. He attributed it to the rice diet (which certainly does not agree with a European) & perhaps to too many raspberries. ...

"In the evening we were much surprised by the arrival of one of the two men who stopped on the snowy mountains on the 8th instant. He reported the death of his companion & had himself been...four days without food or fire. He had passed the other poor lad near the spot where we left him. ...

"14th. Heavy rain all day. The path led along the right bank of the Namlong over steep & slippery rocks. We were obliged to wade the river where it was 100 yards broad, hip-deep, and the current very strong. Burlton had his fever at the time very severely. Many of the people were unable from weakness to cross without assistance. ...

"We reached a Moollook village in the evening, and the sight of the houses in the plain...was pleasing in the extreme. ... We were met near the village by Kampty's[3], who said they had been sent by the Rajah. ... They with great politeness procured us everything that could be wished. ...

"15th. Burlton's ague & fever came on much more severely than before. On his account and the sickness of the whole party we halted for the day. ... We received the same marks of kind attention from everyone.

"16th. ... They had never heard, even by report, of Europeans, & the crowd attracted by our white faces &...the musical Snuff Box was immense[4]. ... In the evening the Rajah's two sons & brother arrived to conduct us to the capital. They shewed some anxiety to know whether we should espouse either side in the quarrel existing between themselves and their neighbours".

20th. Reached the Shan capital, Möng Se. "As scarcely any of our people arrived till very late, the Heir Apparent...very kindly provided us with a dinner from the royal kitchen. It was served up *à la mode Kampty,* on Burmhan lacquered trays, and numerous small china basins. The repast we found so excellent that we hinted we should not be sorry to dine from the same source during our stay. From that time forth 'we feasted sumptuously every day'. We were also provided with a supply of distilled liquor, very much like whisky, but not quite so strong; it was very acceptable, our own small stock being nearly exhausted.

"21st. ... The information that the Irawaddy & Burrumpooter[5] have their sources in close vicinity to each other is derived from Meezoo Mishmees, and there is no reason to doubt their positive assurance. The distance...is...supposed to be about 10 days journey. Majestic peaks covered with perpetual snow are seen to the north. ... In the evening, for the first time for many days, two doubtful altitudes of stars were obtained by Wilcox, which gave the latitude of Maunchee 27° 23′ 43″ [61]. ... A dense crowd surrounded us the whole day & the Snuff Box was kept in constant exercise.

"22nd. Wilcox's foot so bad that he with difficulty moved about. He was able, however, to visit the Chief Priest at his temple; a fine old fellow who was much delighted with all he saw. The only query put by him was whether OUR clergy took unto themselves wives. On being answered in the affirmative, he set up a hearty laugh, & said he was much scandalized at such an improper thing. ...

"In the evening we took advantage of a requisition for the Snuff Box...to exhibit in the house of the Rajah's brother. The women all assembled (and an ugly set of them they were), plainly dressed, with their hair tied up in a very high top-knot, which was ornamented by silver & beads. The Rajah's brother had the honour of feeding the Lions to-day, & in consequence we got nothing but greasy *pork* and oil cakes. Luckily we were not fastidious, having left our prejudices on the Wanglun".

23rd. Return visit to the Raja. "Mentioning our wish to see the Irawaddy he...made much of the danger. ... He would not consent to our going alone on ponies with a mounted guide, but rather than we should be disappointed he proposed our going in great numbers by the shortest route, & past the enemies' villages, running the risk of an attack. ... Of course the proposal was rejected by us. ... An inferior kind of dinner was prepared for us and we were pressed to remain a day or two at the village. We declined, however, staying longer than one night. In the evening all the women assembled on a large mat spread on the turf to hear the Snuff Box; they were prettier than those we saw before, and looked particularly clean and decent.

"24th. We rode off at an early hour, accompanied by a mounted guide, ... and reached the Irawaddy in two hours. As we went at a hard gallop where the path allowed it, we supposed the distance to be 12 or 13 miles. ... We were surprised at the small size of the river, it not being so large as the Now Dehing in Assam; its bed shelving & stony, about 80 yards in breadth. ... It is generally fordable, and at the time not more than 4 feet deep. ... Our guides pointed out to us the direction of the sources of the two branches, Namyu and Namkioo, distant some 40 miles in the mountains.

"We rode back as fast as we came (Ther. 92°), without seeing the much dreaded enemy. We were not allowed, however, ... to pass the Rajah's village without stopping. We were hailed by the great man himself and, nolens volens, we were treated

[1] 10,080 ft. above sea [92, A, E]. [2] *Nam* is Shan for Water or River. [3] Shans of Hkamti Long. [4] My gramophone had an equally appreciative audience in the Southern Shan States, 1906, R.H.P. [5] or Lohit.

with wine and oil cakes, after which we went out to our old quarters at Maunchee, somewhat fatigued by the oppressive heat & the most uncomfortable seat of the Khampty saddle. ...

25th. Attend weekly market, or *Hat.* "The suffocating heat occasioned by the crowd which surrounded us wherever we went brought back Burlton's fever. We were in hopes that the longer we staid the novelty would wear away & that we should enjoy a little quiet. On the contrary, crowds from all the country round came pouring in daily to see us 'once before they died'.

"Wilcox paid a visit to the Boora Rajah to talk of our return. The old man promised a sufficient supply of rice & an offer to pay for it was rejected. He should be ashamed, he said, to take money for anything of the kind. ...

"27th. Wilcox excited the surprize of the Khampty's by entirely taking to pieces the musical Snuff Box, & explaining the nature & use of each part; it was then presented to the Boorah Rajah. They appeared extremely apt in understanding mechanical apparatus, and understood perfectly the sketch of a Still, which they will no doubt put to good use[1].

"28th. Lieut. Burlton being unwell, he started for the small village of Roomtong to get free from the rabble of Maunchee, & if possible enjoy a little quiet. He left at 9; it commenced raining at 10 and continued the whole day. He walked without halting till 6 p.m., when he reached the village quite knocked up. He had his fever on him nearly the whole march, & the distance being about 18 miles, over two hills, the fatigue of such a march in his situation may be better imagined than described. Wilcox remained at Maunchee, expecting a visit from the Rajah", which did not take place.

"29th. Wilcox left Maunchee at 8 a.m. and joined Burlton at Roomtong after 9 hours march".

RETURN. "May 31st. From this we return by the new road [61]. For the first time had a chance of getting lunar distances, ... tho' not easily on account of the numerous clouds. ... In the afternoon...stopped to obtain equal altitudes of the sun.

"June 1st. Halted to allow the villagers to cut our first day's road. From this we shall see no other village till we have descended on the Assam side, some 11 or 12 days hence. The Dam Doom flies are here intolerable. It is wonderful how either custom, or patience, can enable people to live where they are. ... The sores on our hands from their bites are not yet healed, & the leech bites on our feet appear to get worse, although it is more than a fortnight since we received them.

"2nd. An *unconcerned* spectator would have laughed had he witnessed the scene a little before our departure. Burlton had only 3 men left to carry his things, & the other coolies were in such a weak state that they could carry little beyond their own 12 seers of rice. ... We were obliged to give & fling away almost everything we had with us; *useless* articles had gone many days before. ... Shot belts, powder, flints, clothes, shoes, shaving & hair brushes &c., were to be had for the picking up; even soap...was cumbersome to carry. ...

"We marched up the right bank of the Namlong. ... We came to a wretched sort of a suspension cane bridge, over which Burlton & some others crossed at the risk of their necks, & were not pleased to hear that they had to return, the road not lying over it. The bridge was rotten & broken in many places, & when in the middle it swung from one side to the other. ... It consisted of one cane to walk on, & one on either hand to hold by, the whole supported (by means of ribs) on two canes above. The breadth of the river about 90 yards across.

[Here follows Sketch].

"From the bridge we continued our course up the Namlong, over the boulders, crossing & recrossing the river, at times hip-deep. Saw a walnut tree. ... Keeping to the banks of the river we escaped all leeches, but the continued wading rendered the march a disagreeable one. The Dam Dooms are more numerous than ever at our halting place. By tying our trousers tight round the ankles & wrapping our hands in handkerchiefs we obtained a little peace. Shaving was impossible.

"3rd. Rain on starting. We immediately started to ascend. We halted late in the afternoon at a dirty puddle of rainwater, scarcely drinkable, after a long and fatiguing march ascending during the whole day. ... The Sing Phos, guides, and five of the Suddeeyah party (out of 24) were all that arrived at the spot that day. We were in consequence put to our shifts for both a dinner and a bed. Hunger taught us expedients for the one, & fatigue prevented our feeling the loss of the other. Our friends the Sing Pho's gave us a pot of rice which we managed to get rid of very easily, altho' unprovided with plates, spoons, &c.

"4th. By 8 A.M. the whole of our party in the rear (except 4) had arrived, and we again continued our steep ascent, and soon left behind us all forest trees. ... At 12 we saw above us the snow we had to reach. ... From a commanding point, where the view back and around us would have been beautiful, we looked down on a white floating mass of mist and cloud[2].

"The snow first reached lay here and there in patches, ... but as we approached the summit, which we gained by 2 P.M., we found it in large beds...which were some of them about 12 feet deep. The summit of the mountain, which is about 11,382 feet above Suddeeyah, is a tableland, on which our Mishmee guides lost themselves from the loss of their cuts on the trees. ... The Mishmees at last found their old marks, & we descended by the Foonghan R., from its very source. It was covered by the snow a long way down, and we walked over it, hearing the river rolling under our feet with great violence. ...

"We were obliged to stop at last where, from the want of leaves and jungle, no shelter was to be had. ... The ground, too, was a perfect swamp from the thawing of the snow. ... What little wood was procurable was quite wet and rotten, and it was with great difficulty we managed at last to light a fire. Our beds, ... a rug and rezai [quilt] each, had luckily arrived, and by tying up the former above our heads, and wrapping ourselves in the latter, we got a little shelter from the rain and after getting another meal from our friends we managed to sleep, ... but it was without exception the most wretched & miserable night we had passed.

"The rest of the party, wrapping themselves in their scanty clothing, passed the night round the fires.

5th. Obliged to remain at our uncomfortable situation on account of the number of men who were unable to *conquer* the snowy mountain yesterday". Three men were sent to bring them in, and found them bewildered by the many tracks left by the main party. "One poor fellow who had exerted himself till late in the evening...had passed the night alone on the very summit without food or fire. By 10 o'clock the whole of the laggers had arrived with the exception of 4 men. ...

"June 6th. Leaving the Phungauk to our left, we mounted the ridge which looks down on both east & west. ... Turning to our left, we crossed several small heights, and soon found ourselves in our old path at the top of the Foongan pass. ... In addition to sore throat and a bad cold, Burlton was again attacked by fever. We found all the snow which we passed on our former route melted, & halted early at the huts we built on the 7th May; having thus made in 4 marches by the upper road what took us 7 by the other".

[1] distilling liquor! [2] A familiar feature of Burma hills and valleys.

They now followed their old route, recognizing the old landmarks. "On the right bank of the Dehing...we were here tormented by a new pest in the shape of curious species of caterpillar which either bit, stung, or scratched (we could not determine which) most severely. These beasts, with bumble bees, ants, Dam Dooms, leeches, and mosquitos, prevented our sleeping, and from having so lately come from the cold region of snow, felt the heat most oppressive. ... Burlton did not close his eyes during the night, & Wilcox was in nearly as impatient a situation. ...

"11th. Off in the rain. Some difficulty in crossing the Dehing on bad rafts. Wilcox was upset, but being a good swimmer he got safely on shore, with a double barrel'd gun in one hand and a spear in the other. Pushed on, crossed the Dupha by the cradle suspension bridge, & halted late at Koomkoo, having made two of our former marches. ...

"13th. Could not return by the road we came, the Dehing not being fordable. We reached Kusan in the afternoon, and were agreeably surprised to find the Gaum had not drunk the beer formerly left at his village. Here end all our troubles from marching, wading, climbing, slipping & falling, and all our torments from leeches, Dam Dooms, sand flies, bugs, ticks, et id genus omne. The only difficulty or danger remaining is in passing the rapids.

"14th. Got our dingys into the river & made them safer, fastening bamboos to their sides. The river rose so much to-day that the Sing Pho's said it would be very dangerous our attempting to go down the rapids. Not much liking the looks of it ourselves, and the weather continuing unfavourable, we remained at the village.

"15th. The river still high & very boisterous; nevertheless we moved off at 9 A.M.; the first 4 or 5 rapids were so bad that we got out and lowered the dingys. We then went off and almost flew down the remaining rapids, the water coming in at the bow, & fairly sweeping the whole length of some of the dingys. In 3 hours we went a distance which took us four days going up. It was laughable to observe our Mishmee guides; being no 'water birds' and unable to swim they held on like 'grim death', expecting every minute to be upset. Passed an uncomfortable night in our dingys; it rained heavily and our chappahs[1] leaked.

"June 16th. Arrived at Suddeeyah"[2] [61].

During cold weather 1827-8, Burlton was emp. under Scott on svy. of route over Khāsi Hills via Jaintia, improving footpaths and building occasional bridges [64, 515]. In March 1829, he took sick leave with Bedingfield to the newly built sanatorium at Nongkhlao. "The Khāsia Hills were first visited by Europeans in 1828. In return for permission given to the Rajah of Nungklao to rent certain lands formerly held by him in Assam, the Khāsis consented to a road being made through their hills to unite Assam and Sylhet, and a sanatorium established at Nungklao.

"This good understanding was, however, speedily undermined by the insolent speeches and behaviour of the...employees working on the road. The simple hill-men were told they would soon be subjected to taxes. A general conspiracy was formed among them to exterminate the new-comers, and on 4th April 1829 the Khāsias murdered Lieuts. Bedingfield and Burlton, the only two British officers at Nungklao, with all their followers. A long and harrassing hill warfare commenced. ... It was not until January 1833 that the Nungklao Chief surrendered"[3].

A more detailed account is given in a contemporary letter. After Bedingfield's cruel murder [423] "poor Burlton, seeing his friend's fate, defended the house assisted by a few sepoys of the Assam Light Infantry and his servants, and held out in gallant style for a day and a night, until the house was set on fire, when they sallied out and, by keeping up a constant fire, kept the savages off; until a dreadful shower of rain coming on wetted their ammunition and rendered their fire-arms of no use.

"The small party then dispersed, a few of those who took shelter in the jungles escaped, but Burlton and an European writer (Bowman), having both kept the pathway, were immediately massacred. The former was in the act of extracting an arrow from his wrist when he was cut down, being in an exhausted state from the immense exertions he had made, and his previous ill-health"[4] [64, 448].

BURNES, Alexander. Bo. Inf.
b. 16-5-05. Assassinated, Kābul, 2-11-41.

Ens. 6-6-21 ... Bt. Major 23-7-39.

Son of James Burnes, Writer to the Signet & Provost of Montrose; his sister Jane m. James Holland [462].

ed. Montrose Academy. Kt. Bach. 1838.

DNB.; DIB.; Ency. Brit.; Bokhara; Court of Sinde; Indian Officers; Pioneers in India; Oriental Club.

1823, Persian Interpreter at Surat; 1825, DAQMG. Cutch; svys. and maps, Cutch & Sind[5] [128, 131]; 1828, AQMG. and asst. to Resdt., Henry Pottinger [II, 437-8]. His bro., Dr. James Burnes, Resdcy. Surg. at Cutch at same time, was auth. of *Narrative of a visit to the Court of Sinde*, which included map of Alexander's, with amendments [131][6].

"Dr. James Burnes...went to Hyderābād in 1827 to prescribe for one of those princes, and established himself on the best of terms with the whole family by swallowing draught for draught and pill for pill with his illustrious patient"[7].

Early 1828 to Deesa, and with Holland in 1830 traversed s. and w. Rājputāna with intention of exploring Indus from north [132][8]. Recalled from Jaisalmer to lead mission to Ranjīt Singh at Lahore, taking gift of horses from King George of England, the start of a career of adventure and exploration beyond NW. frontiers [452, 486-7, 508].

Thomas Jervis (34) claims to have instructed Burnes "in all the preparatory essentials of Geography".

BURNEY, Henry. Ben. Inf.
b. Calcutta, 27-2-1792. d. at sea, 4-3-45, on voyage to England; MI., S. Park St. cem.

Ens. 30-8-08 ... Lt Col. 17-1-34.

Son of Richd. Thos. Burney and Jane Ross his wife; related to Fanny Burney, novelist (1752-1840), *DNB.*

m., Penang, 30-6-18, Janet, niece of J. A. Bannerman, Govr. of PWI.; she was 1st cousin of wife of Fredk. Dangerfield [435].

Hodson, I (257); *The Burney Papers*, printed by order of the Vajiranana Nat. Lib., Bankok, vol. I (745).

1816-20, at PWI.; 1821-2, with Crawfurd's mission to Cochin China. 1824, with asstce. of Geo. Gibson [71, 453-4] compiled map of Burma, Siam and Cochin China [79], for which, with one of Burma on a larger scale, [298] he was granted reward of Rs. 5,000[9].

[1] Grass mat shelters. [2] DDn. 224 (20-52), 4-7-27. [3] *NE Frontier* (24). [4] *Ben Ob.* (375). [5] IO. Maps, Uk. [6] Review, *JRGS.* I, 1832 (222-51). [7] Davis (12). [8] Paper with map, *JRGS.* IV, 1834 (88-129). [9] *IHRC.* Delhi 1948 (151-2).

1825, PA. Siamese States; Dec. 1826, succ. Crawfurd as Envoy at Ava[1] [437].

BURNS, William Nicol. Mad. Inf.
b. 9-4-1791. d. 21-2-72.

Ens. 7-2-11 ... Maj. 31-2-35; ret. 19-1-43, as Lt Col.; Hon. Col. 28-11-54.

3rd son of Robert Burns, the poet, and Jean Armour his wife; bro. to J. G. Burns, Ben. Inf. (1794-1865).

July 1813, MMI. cl. VII (II, 321).

Marātha War, 1817-9, route svys., Berār & Khāndesh, with Hyderābād Subsy. Force; DDn. 246 (151), 23-2-20.

BURR, Frederick William. Nizām's service.
d. 19-4-33, Khammamet, Hyderābād.

Lieut. & Adjt. 2nd Batt. Russell's Bde., 1820-1 [341].

nat. son, of mixed blood, of Lt. Col. Chas. Barton Burr, CB. Bo. Inf.; possibly identical with F. W. Burr, free mariner, Bombay, 1813[2].

1817, with 1st Batt. at Mehidpur, 21-12-17.

Crofton, II (172).

On Henry Russell's departure from Hyderābād, Burr was left in ch. of his colln. of maps including Burr's own svy. of Barsu, etc.; in letter dated Bolarum, 29-5-21, Burr refused to pass these latter to Thos. Hill [117].

Supplied maps of Nizām's Dominions, including his own route svys., for Henry Adams' Map of Mahrashta [281].

BUXTON, Bentley. Ben. Engrs.
b. 26-9-1796. d., Singapore, 28-2-25.

Ens. 25-4-17 ... Lieut. 1-9-18.

Son of Thos. Bentley and Anne Buxton, of N. America.

ed. Addiscombe, 1811-4.

Hodson, I (270).

1815-6, svy. course with Trig. Svy. of Gt. Britain; BGO. 27-9-16, to svy. Dum Dum cant.

BGO. 24-4-18, to svy. Cuttack, Orissa [II, 23-5; III, 17-9, 290]; had more than two years strenuous work in a difficult, unhealthy, country, with but a few weeks visit to Calcutta. "Hasten here" writes Mackenzie, 25-7-19[3], "I shall be glad to see you. You will have one of the finest establishments to set off with next year; two Madras, two Calcutta, assistants, fine young lads" [361, 478].

Closed field svy. Feb. 1821, SG. writing; "Lieutenant Buxton is an able and zealous officer, and was usefully and actively employed...until February last, when he was attacked by sickness, and he is still suffering from ill health, probably in consequence of exposure and fatigue"[4]. Buxton's work later won the cordial approval of that severe critic George Everest, as being "founded on principles analagous to those of the Great Trigonometrical Survey"[5].

BTC. 19-10-21, appd. to supd. completion of Customs Ho., Calcutta; 1822-3, Bkmr., Ghāzipur; 1823, Asst. Supt. Pub. Buildings, Lower Provs.; 3-7-24, leave on mc.

Govt. Gaz. 2-5-25; d. at house of J. A. Maxwell[6], Singapore "He visited China at the close of last year for the benefit of his health, and returned to this settlement in a very dangerous state on 19th February".

CAMPBELL, Andrew Mitchell. Mad. Cav.
b. 10-3-1793. d., 15-9-50 "of unsound mind."

Corn. 7-9-11 ... Capt. 22-9-30; ret. 1-7-38, with rank of Major.

Son of Wm. Campbell, of Fairfield.

July 1813, MMI. cl. VII [II, 321]; BMC. 11-11-16, to svy. passes in Nāgpur territory [84].

1833-7, in England; permitted to return to India, 1-3-37; "of infirm health, with very weak voice and eyesight, due to exposure to sun".

CAMPBELL, John. Bo. Inf.
b. Oct. 1803. d. 20-3-84.

Ens. 28-2-20 ... ret. as Capt. 12-8-31.

Son of Capt. Colin Campbell, RN.

22-8-22 appd. Asst. Survr. Deccan Svy., but "at an early period of his field duties has been so ill as to be compelled to proceed to the sea coast for the benefit of his health"[7]. 1-12-22, reported as "qualified to perform all his duties as surveyor", and fit to draw staff allowances; 1-3-24, Asst. Survr. 1st cl. [125 n.12].

Nov. 1824, leave to England on mc., sailed in ch. of invalids, 10-12-24, returning Bombay 25-1-27.

CAMPBELL, Neil. Bo. Inf.
bapt. 8-10-01. d. Paris, 10-10-56.

Lieut. 23-5-18 ... Lt Col. 18-8-47; Bt. Col. 28-11-54; Bde. comdr. Ahmadnagar, 1855; furl. 19-7-56.

nat. son of Col. Campbell, of HM. service.

m., Baroda, 18-2-30, Elizabeth Pollexfen, widow.

Bo GO. 26-5-20, appd. Asst. Survr., Deccan Svy. [125 n.12]; Aug. 1826, DAQMG. Mālwa Fd. Force; 30-5-35, DQMG., as Maj.

1st Afghan War, 1839-41; sd. maps by Bo. survrs.; B to CD. Mil., 2-3-42, "claims to be considered one of the authorities of the map of Afghanistan; his name to be inserted in next edition".

MRIO. 190 (9). sd. plan and panorama shewing bridges across Indus at Bukkur, for crossing by army on 14-2-39.

QMG., Bombay, 27-2-40; 3 years furl., 2-11-50.

CHALLEN, George. Bo. Inf.
bapt. 21-10-1782. d. Bombay, 9-11-25.

Ens. 15-6-02 ... Capt. 8-12-18.

Son of John Challen and Cassandra Lintott his wife, only dau. of Henry Farncomb of Sussex.

1818, Svy. of passes, Chandur Bāzār[8] to Ajanta; routes to & from Poona [352]; Dec. 1818, appd. Asst. Survr., Deccan Svy., as "an officer of great zeal and merit" [125]; MRIO. 124 (15), Svy. of part of S. Konkan.

July 1820, tr. to svy. of Sātāra, Sutherland reporting that his "indefatigable exertions have contributed so much to the advancement of the map" of the Deccan[9] [126, 171, 281].

After starting the Sātāra rev. svy., Challen handed over to Adams [344, 422], and then comdd. Pioneers till death.

CHEAPE, John [II, 385]. Ben. Engrs.
b. 5-10-1792. d. 30-3-75.

Ens. 3-11-09 ... M Gen. 20-6-54; ret. 1857; Gen. 1866; Col. Comdt. Engrs.

Son of John Cheape, of Rossie, co. Fife, and Elizabeth his wife.

m., 1st, St. Helena, 5-3-35, Amelia Frances, dau. of T. J. Chichely Plowden, BCS., widow of G. M. Batten, BCS., whom he divorced 1841.

m., 2nd, Agnes Macpherson.

ed. RMA. Woolwich. GCB. 1865.

DNB.; *DIB.*; Thackeray (6); Hodson, I (335-6).

BGO. 13-8-& 14-10-14, appd. to svy. Chittagong Dist., continued without interruption by Nepāl War

[1] note on Pagan, *JASB.* IV 1835 (400-4). [2] *EIR.* 1814. [3] DDn. 156 (163). [4] DDn. 196 (88), 15-9-21. [5] DDn. 265 (118), 10-1-31. [6] Jas. Alex. Maxwell b. 1777; Bo. Med. 17-9-1834; Crawford's *Roll* (328). [7] Bo MC. 137/1824 (131-7), 1-2-24. [8] 15 m. E. of Ellichpur, pl. 17. [9] Bo MC. 12-7-20.

[II, 19; III, 11-2, 201, 217]; completed in 1818, Mackenzie reporting;

"A young officer, Lieut. Cheape of Engineers, has solicited my good word for the assistantship, in case Lieut. Hyde had been provided for in Sumatra [462], and I really was impressed with...the excellent...map of the province of Chittagong. ...

"Mr. Hyde's return has cancelled it in a manner, and... Mr. Cheape has employment in the field, where he has sent me specimens...that evince some capacity for those light and comprehensive sketches that are so useful on field service. For regular mapping and provincial details he has shewn his talent. Whether duly qualified for the more abstruse parts of survey I have had no opportunity of seeing"[1].

Again, to Thomas Wood; "What is become of your friend Cheape? I feel interested for that young man. ... His map...of Chittagong is the best I have got here"[2].

MRIO. Misc. 21-0-17; panoramic view of Chittagong Hills, with autograph.

Marātha War, 1818-9, with S & M., Asst. Fd Engr. 2nd Bde.; at siege of Asirgarh, 6-4-19 [83].

27-2-23, appd. ASG. in succession to Herbert [309]; Oct. 1823, to S. Chittagong to svy. frontier with Arakan, remaining on mil. duty after outbreak of Burmese war [67]; nominated, 8-4-24, Fd. Engr. with army to Rangoon; 12-6-24, thanked in GO. for service at capture of Kemmendine stockade; BGO. 16-2-25; four mo. leave to Calcutta.

22-9-25, resumed appt. as ASG.; BGO. 30-9-25, appd. to svy. and report on state of new Jagannāth road; Feb. 1826, tr. from Survey to PWD., at Midnapore[3] [301, 310, 496].

Ben Regr. 4 (16), Dec. 1829, svy. of road, Hooghly to Burdwān; MRIO. 46 (5), Midnapore to Bishenpur.

Distinguished mil. career; siege of Multān, 1848, with rank of Brig.; 2nd Burmese War, 1852, comdg. Ben. Div., and comdg. force from Oct.; CB. at end of campaign.

COLVIN, John [II, 391]. Ben. Engrs. b. 20-8-1794. d. 27-4-71.

Ens. 15-9-10 ... Lt Col. 20-4-35; ret. 4-9-39.

Son of Thos. Colvin, merchant of Glascow.

m., Ludlow, Salop, 27-2-38, Josephine Puget, dau. of Capt. Joseph Baker, RN.

ed. Addiscombe, 1809-10.

Hodson, I (368-9). *Oriental Club.* Sandes, II (4).

Nov. 1815, Fd Engr. with D'Auvergne's force against Saugor, CI., survg. area near Terowah[4]; BMC. 14-6-16 (41), on repair and alterations to Hānsi fort; Marātha War, Oct.-Nov. 1818, survd. route of Brig. Arnold's force on Bhuttee frontier [24].

BGO. 18-3-20, to svy. the ancient canal in Hariāna Dist.; ib. 9-6-21, appd. Supt. of Canals, Delhi, from Sept. 1820 in succession to Blane [II, 383; III, 24]. Handed over to Richd. Tickell, July 1821; 1820-5, on svy. and reconstruction Ferozeshah canal; 1827, resumed appt. as Supt. till ret.; History of Canals [24 n.3]; maps MRIO. 160 (25-7), *JASB.* II, 1833 (105). Collections of fossils, ib. V, 1836 (179-84).

CONNER, Peter Eyre[5] [II, 391]. Mad. Inf. b. 5-8-1789. d., Hyderābād, 29-4-21, unm.

Ens. 28-2-07 ... Capt. 3-11-20.

Son of John Connor (*sic*), of co. Donegal.

June 1807, MMI., cl. III [II, 320]; 1810, Goa Svy.; 1811, reverted to unit; 1813, joined Garling's svy. of Sonda [II, 158-9; III, 94, 97].

MPC. 8-12-15, appd. to ch. Coorg Svy. [97, 339, 408, 474]; 22-12-17, joined Ward at Quilon on Travancore Svy. [4, 109-10, 511]. According to Riddell "more of a man of the world than Ward" [408].

On Garling's death, 4-6-20, offered ch. of Hyderābād Svy., and replied, 28-6-20; "Ward has written a few lines. I am aware what his friendship has induced him to say of me, but ...he has the fairest claims to be allowed the selection, and in point of zeal and indefatigable exertion would be amongst the best substitutes for our departed friend [450].

"In assuming to myself some share of those qualities, I am liberal in my own praises, but I must not...pretend to that theoretical knowledge and science possessed by poor Garling; in fact, my duties rendered it unnecessary, and the practice of it not being required I have too much postponed the study. I am not aware of the duties to be performed in the Hyderabad survey. ... As for the ordinary ones of the department, I feel all the disposition...to prosecute them with advantage, and...long practice will...have taught ...their performance.

"Ward's inclinations would not lead him northward. ... As for my own, my first wish is a champagne country, or rather I most deprecate a feverish one. I have latterly been happy enough to recover much of my usual health, and... got entirely rid of my Soonda fever, from the effects of which I suffered for three or four years most severely"[6].

Ward added; "I do not hesitate in proposing that my friend Conner be appointed to succeed. His superior qualifications entitle him to it, as I am sure he will do every justice in furthering the labours of his late friend. ... In 3 months or less he will...complete the papers and plans of this survey"[7] [340-1, 350, 390].

On march from Cochin to Madras in Jan. 1821, Conner's party ran into a cholera-stricken patch [401]. They moved on to Hyderābād at the end of Feb., but soon after his arrival Conner was taken seriously ill, and Mountford reported that he had "arrived at Hyderābād on the 11th ultimo, but in so indifferent a state of health as not to admit of his making any arrangements for commencing the survey. His complaint (a dysentery) had yielded to the treatment of his medical attendants, when a fever came on which baffled all their efforts, and terminated his existence on the 29th ultimo"[8] [117-8, 341, 401].

CRAWFORD, John. Bo. Mar. d. 10-11-43.

Mdpn. 6-9-02 ... Senr. Capt. 3-4-28.

Burmese War, 1825, comdg. svy. ship *Research* on Arakan coast; obsns. of lat.; 1827, "Captain Crawford, the midshipman whose zeal...with Lord Valentia had been rewarded by a grant of Rs. 200 [II, 392, 429], surveyed part of the coast of Arakan in a hired brig [70, 181, 199]. John Crawford, in his Embassy to Ava, speaks in the highest terms of Captain Crawford's surveying work"[9] [434].

Low, II (10); "only less distinguished as a surveyor than Capt. Ross [499] and worthy of being ranked with McCluer and Court [I, 355; II, 391-2].

CRAWFURD, John. Ben. Med. b. 11-7-1783. d. 11-5-68.

Asst. Surg. 24-5-03; mil. service, NW. India; to PWI. 1808; 1811-7, pol. dutyJava [II, 380]; 1817-20 furl.; 1821-3, Embassy to Siam & Cochin-China; 1823-6, Administrator, Singapore; 1826-7, Comnr., Pegu; 1827, Embassy to Ava.

[1] DDn. 154 (21), 12-9-18. [2] ib. (39), 21-10-18. [3] cf. Sandes, I (253 *et seq*). [4] DDn. 131 (172), 12-1-16. [5] full name from Mad. Wills. 1821. [6] to Mountford, DDn. 149 (128), 28-6-20. [7] ib. 27-6-20. [8] DDn. 192 (112-3), 7-5-21. [9] Markham (10).

Son of Dr. Samuel Crawfurd, physician, of Islay, Hebrides.
m., 1st, Miss Robertson, lost at sea with child on voyage home.
m., 2nd; 1820, Horatia, dau. of James Perry; she d. 1855.
ed. Edinburgh.
FRS. 7-5-18; FRGS., VP. 1866.
DNB.; *DIB.*; Crawford; Crawford's *List.*; *Oriental Club*; RGS. Progs. XII. 1868 (234-8).

Not a survr., but encouraged geographical research in Burma & Far East.

BGO. 5-10-21, appd. AGG. for mission to Far East, which sailed Oct. on pol. and commercial affairs; took Burney as asst. [431] and Dangerfield as unofficial survr.[1] [267, 435-6]. "Mr. Crawfurd, the author of a work on the Indian Archipelago, was about to be employed by the Marquis of Hastings on a mission of a very important nature as regards the commercial interests of this country. Its object is to explore the coasts of Siam and Cochin China, to ascertain accurately the productions of each inhabited district. ... It was his intention, in the first instance, to proceed to...Singapore"[2].

Burmese War, after arrl. of British army at Rangoon in May 1824, Crawfurd recdd. British occupation of Tavoy & Tenasserim, as link with Malay States & Penang[3]. His memo. with map passed to SG.

March 1826, after treaty of Yandabo [70] appd. Civ. Comnr. Pegu [75 n.1, 78]; on 31st left Rangoon with Capt. Studdert, SNO., and explored Moulmein R. to Martaban. On 6th April "at 12 o'clock the ceremony of hoisting the British flag and fixing the site of the town...took place. ... The new town and harbour were called Amherst [74, 456]. ...

"Every morning since our arrival Capt. Studdart was employed...in examining and sounding the harbour and its approaches. On afternoon of 8th we quitted the new harbour on our return to Rangoon, arriving there on 10th. April[4].

Sept. 1826, on mission to Ava which led to est. of Envoy there [78, 432, 437]. Jan. 1827, revisited Amherst, the journey from Rangoon, about 100 m., taking exactly 24 hours. "Here we found lying the Government surveying ship Investigator, with Captain Ross, the Surveyor General" [17][5].

Auth. of *Journal of Embassy...to Court of Ava*, which contains map by John Walker "of the Admiralty", from materials largely supplied by Crawfurd, who acknowledges work of Thomas Wood, Thomas Fisher, John Crawford of the Marine, Burlton, Wilcox and Pemberton"[6] [65 n.12, 79, 433, 494].

Auth. of *History of the Indian Archipelago*, pub. 1820, 3 vols.; and *Descriptive Dictionary of the Indian Islands*[7] 1856; was keen linguist and leading supporter of the Ethnological Soc. after ret.; auth. of *Malay Grammar & Dictionary*.

CRISP, John Henry. Mad. Inf.
[8]b. 27-8-89. d. Calcutta, 22-4-70.

Lieut. 17-7-05 ... Maj. 2-9-32; inv. 1-4-33.

Nat. son of Burrish Crisp (1764-1811), BCS. [II, 31 n.11]; his sister Elizabeth Margaret m. John Fombelle (1763-1849), BCS.

m., pr. England 1819-20, Lavinia Constantia; eld. son b. 22-9-21. Of their 6 children, the yst., Emily Meikle, m. Banzigar, took probate of her father's will, 1870.

March 1810, MMI., cl. VI [II, 321].

MGO. 1805; "Mr. John Crisp, ... particularly assiduous in the study of the Hindoostanee language, ... to be ensign from 17th May 1805, and to be Lieutenant from the same date". MGO. 16-2-08, leave to Bengal for 6 mo.

MMC. 10-3-09, nominated for MMI. in place of officers removed for insubordination [II, 314, 320], but did not join till March 1810; 31-8-09, advised to sign loyalty test [II, 314][9].

MGO. 8-1-19, to Europe on mc; arrd, England without wife 6-9-19; returned Madras with wife, landing 15-6-21.

MPC. 22-1-22, "appd. to conduct, under the superintendence of the Hon. Company's Astronomer [191], the operations of the party proceeding to the west coast of Sumatra for...determining the length of the Pendulum at the Equator" [255][10].

Sailing 13-3-22 to Fort Marlborough, or Benkulen, the party obsd. on a nearby island between Jan. and March 1823, and were back at Madras in June. During the expn. "a detachment of troops from Fort Marlborough, commanded by Capt. Crisp, has, with the assistance of some friendly native Chiefs, taken a small fort to the northward of the settlement, which was occupied by a refractory rajah"[11].

With a claim for special allces. for stay in Sumatra, Crisp submitted "documents in proof of my having been in command of the troops and station of Bencoolen, and of the northern settlements of Sumatra, without...emoluments. ... The accompanying letter from...the late Resident at Nattal will, I trust, satisfy...that the duties...under his orders were ...zealously discharged; yet for the period of a year I was employed...without the receipt of any allowance except the difference between my tent allowance and the lodging money of my rank"[12].

On return, appd., MGO. 25-7-23, to ch. of the Hyderābād Svy. to succ. Young [5, 118-9, 208, 342, 418]. MGO. 8-7-25, granted 2 mo. leave to visit Presdcy., writing to SG., 1-8-25, "If an assistant officer to this survey had been appointed, ... I might have been spared the more readily for a month or two from my duties here. ...

"The opportunity offers of proceeding to Calcutta by the ship upon which my sister-in-law is a passenger[13]. If therefore you should conceive that my services here might, without detriment, be dispensed with for a short time, it would be a great benefit that what I propose should be submitted to a practical test in Calcutta.

"I am this day starting for Madras to receive my sister-in-law, who comes on the William Miles, Captain Beadle"[14].

The matter to be put to test was a method of finding longitude "from a few altitudes of the moon", which Crisp claimed to have discovered himself; "extremely simple when once the different data are prepared, the trouble being to reduce these to their greatest possible exactness" [191].

His proposals fitted with the SG.'s wish to summon him to Calcutta to assemble the svy. records in methodical order [118-9], and before returning from Calcutta, he submitted "a Treatise which I have just published upon the methods of determining terrestial longitudes by the right ascensions of the Moon[15]; and...tender it to the countenance and patronage of the Supreme Government. ... I am not aware that in this branch of astronomy there is any work of such general scope, and such simple construction"[16].

He sailed from Madras 10-11-25, reaching Calcutta 24th. For the next year acted as ASG. in addition to his work on the Hyderābād records [309-10, 321, 376]. He then asked to stay for an extra month "as

[1] DDn. 193 (1), 28-9-21. [2] *As J.* XIII, April 1822 (405); XVIII, Oct. 1824 (378); XIX, Jan. 1825 (12). [3] DDn. 230 M 414. [4] Crawfurd II (88). [5] ib. (59). [6] ib. (162-3). [7] *HMS.* 542. [8] from Ben. Eccl. (4/125), bapt. Calcutta July 1791; Cad. PP 1804 (250) gives b. Aug. 1788; bapt. 24-11-88. [9] Cardew, appx. F (205, letter 25). [10] Wilson, W. J. (259) E. [11] *Ben. Harkaru*, 9-1-21; quoted by *As J.* XVIII (86). [12] DDn. 204 (249), 6-7-26. [13] No bro. being known, the sister-in-law was pr. his wife's sister, possibly one of his fellow-passengers in *Sir Edward Paget* to Calcutta; Mrs. Davidson; Miss Hagar; Miss Adair; Miss C. Adam. [14] DDn. 202 (177), 1-8-25. [15] GBO. Lib. Ea-95. [16] DDn. 147 (364-6), 26-1-27.

private affairs of a very urgent nature require my presence at Calcutta during the ensuing month"[1].

He resumed ch. at Hyderābād 4-4-27, and 3 months later was tr. to be "Mahratta Translator to the Tanjore Commissioners"[2] [209, 310]. 11-2-48, to act, as Astronomer *vice* Taylor [191].

In 1854 Waugh writes that "Major Crisp, now on the Invalid Establishment at Madras, ... was a scientific and able officer".

CROMMELIN, James Arden. Ben. Engrs. b. Calcutta, 2-2-01. d. 30-1-93.

Lieut. 1-5-24 ... Capt. 12-1-34; ret. 1-1-43; Hon. Lt Col. 28-11-54.

Hodson, I (415).

Burmese War, Arakan, 16-9-24, placed under orders of Schalch [68, 333]; from Feb. 1825, with Wroughton survd. route to Arakan city, and worked on map during rains [68-70, 181-2, 440]. Oct. 1825 to March 1826 survd. towards Taungup [69, 73] and Sandoway, being then granted leave; "I have now been with this force since July 1824, and been exposed many months to the baneful effects of the Aracan climate". 20-9-26, writes to SG. from Ex Engr's office, Chinsura; "Not having been able to get into a house of my own at Chinsura, and the consequent confusion in my affairs, I have not made any progress in themap"[3].

Ben Rrgr. 6 (29, 30); road svys., Calcutta to Jessore & Krishnagar, 1834.

CE. Lucknow, 1850.

CRUIKSHANK, James. [II, 393]. Bo. Inf. b. 24-4-1788. d. 29-11-53.

Ens. 14-9-04 ... Maj. 25-5-29; ret. 30-4-31.

Son of John Cruikshank, clerk in Navy Office, and Barbara Sutherland his wife; cousin to James Sutherland, Bo. Inf. [II, 443-5; III, 504]; sister, Christiana Louisa, m. Henry Adams [II, 376; III, 422].

m., Camberwell, 15-11-38, Eliza King Josephine, dau. of Joseph Bothamley.

Under SG. from July 1808; 1809-10, on w. Gujarāt Svy. [II, 171-2]; "very valuable" route svys. N. Konkan; from 1811, Asst. Survr. on Broach Rev. Svy. [II, 188]; from 1820, in ch. rev. svy. in Gujarāt, covering Surat, Kaira, and Ahmadābād dists. [128, 170]. On departure of Williams, Nov. 1821, held ch. of Gujarāt rev. svys. till closed down in 1829, when he took furl. [6, 129, 170-1, 281, 322-3, 343, 383].

CULLEN, William. Mad. Art. b. 17-5-1785. d. Cochin, 1-10-62[4].

Lieut. 21-6-03 ... Lt Gen. 11-11-51.

Son of Archibald Cullen, barrister, and Finella Sinclair his wife.

ed. RMA. Woolwich.

1821-2; compiled drawings and records of rise and fall of ground as obsd. by barometer during extensive travels on duty, and collected from other sources [205].

CUNINGHAM, William. Mad. Inf. b. 1793. d. 1837.

Ens. 29-6-10 ... Capt. 11-10-28.

nat. son of Sir Wm. Cuningham [-Fairlie], of Auchnskeith, 6th bart., and Janet Young.

July 1815, MMI., cl. IX [II, 321]; 20-10-20, appd. Survr. Deccan Svy. [125 ns. 6, 12, 208, 212]; Bo MC. 1-3-24, resgn. accepted.

CURNIN, John. Company's astronomer at Bombay. d. July 1849.

Appd. Astr. to EIC., 13-9-22; arrd. Bombay 1823; dism. under order of CD to Bo. 21-5-28.

m., 1st, Catharine, who d., Calcutta 16-7-44, in her 52nd year; MI. RC. Cath[5].

m., 2nd., Calcutta, 31-5-45, Ellen Goulding, wid., dau. of Edw. Seymour.

Appd. on recdn. of Henry Colebrooke [II, 386], being resdt. of Halifax St., Mile End, London.

After arrl. Bombay, 1823, supervised design and construction of Colaba obsy., but protested that little could be done with insts. provided. On fresh insts. being sent out, returned them to London, with report that "teems with invectives, and imputes motives...for which there is no shadow of a foundation". The Directors ordered his dismissal [192].

The only fruit of his prof. work is contained in two papers on subject of moon-culminating stars, pub. by RAS. [192 n.6].

Though offered free passage to England, he preferred to move to Calcutta, and in 1832 appd. Asst. Assay Master, Mint[6]; succg. James Prinsep as Assay Master in 1838.

In 1834, had trouble with De Penning regarding loan of insts. from SGO. for obsn. of Opposition of Mars. Everest protested against the loan, and counselled De Penning "to have no verbal discussion with Mr. Curnin—to say as little to him—and every other man you meet with in life whom you find quarrelsome—as you can possibly" manage[7].

Member of RAS. from 1827, and of ASB. after arrl. Calcutta; *JASB.* III. Feb. 1834 (94-8), "Catalogue of stars to be observed with the moon in March & April 1834. *JASB.* VIII. June 1839 (533), Curnin prohibits his asst. "from devoting any portion of his time to maintaining meteorological observations at the Mint."

Distressed by delay in granting qualification cert. at Mint, "and...so importunate...that it was no longer withheld".

CD to India, Fin. 13, of 1-7-46 (11-2); "After the repeated acts of insubordination of which Mr. Curnin has been guilty, terminated by misconduct so inexcusable, ... his removal from the office...is indispensable. You will accordingly relieve him from the duties". Handed over at Mint 27-8-46, and reported arrl. London 1-12-46[8].

Appears to have returned to Calcutta to become clerk to Sir Lawrence Peel, CJ. from 1842, Calcutta High Court[9].

RAS (mn). XI. 15-2-51, records death, which occurred at Calcutta, July 1849. His executor, 1849-50, was Mrs. Ellen Curnin. Death is at same period recorded in Calcutta of Mr. Jeremiah Curnin. Miss Curnin, "an infant", sailed from Calcutta for Suez, 7-1-54.

DANGERFIELD, Frederick. Bo. Inf. b. 25-8-1789. d. Indore, 6-12-28; MI.

Ens. 20-6-05 ... Capt. 19-2-20.

Son of Thomas Dangerfield, of London and Mary Anne Lapidge his wife.

m., Penang, 14-5-23, Mary Dioné Bannerman, dau. of J. A. Bannerman, late Govr. PWI.; 1st cous. to wife of Henry Burney [431]; had 2 sons in Mad. army.

BMC. 26-8-09 (39), being on leave from Bombay on mc., allowed leave to Europe on mc.

Marātha War, 1817-8; with fd. dett. under Lt-Col. Corsellis[10].

From May 1818, on svy. in Mālwa under Malcolm who refers to his excellent work; "His assistance was

[1] DDn. 147 (356) 30-11-26. [2] MMC. 24-4-27; DDn. 184 (413). [3] DDn. 213 (99, 117), 3-2 & 20-9-26. [4] Cotton (908). [5] *Ben Ob.* (307/169. B. 8) [6] Com corr. 5-9-32. [7] DDn. 289 (162-3), 17-11-34. [8] *PP (HC)*. Comd. Paper 153, 7-3-48. [9] *B Dir & A. R.* 1853. [10] Thos. Corsellis, Bo. Inf., Lieut. 1791; M Gen. 1837; CB.

not limited to his accurate surveys and to objects of science. He furnished many valuable papers on statistical subjects, particularly regarding the Bheels [I, 126 ; III, 123]"[1].

MRIO. M 399, 401 ; fdbks. of route through Udaipur, etc., with excellent sketches, and obsns. for lat. [181 ; pl. 9].

Dec. 1819, appd. to svy. opium production in Mālwa, filling up gaps in earlier svy., with geol. and statistical svy. [267]. Nov. 1820, Malcolm reports that "the state of that valuable officer's health renders him quite unequal to continue in the active duties of the Survey Department. He will spend one or two months completing the map"[2].

For his svy. Dangerfield had "directed astronomical instruments, philosophical and chemical apparatus, cabinets of geological specimens, and the latest and most authentic works on general science, to be sent to him from England. These have all arrived tho' unfortunately too late for the present survey. ... Cost amounts to nearly 6,000 rupees"[3].

Granted 9 mo. leave from 12-3-21 for sea voyage on mc.; arrg. Calcutta April, joined Crawfurd's mission to Siam and Cochin China[4], which sailed in Oct., and returned in 1823 [218, 267, 431, 434]. Married at Penang in May. Before his start it was arranged that he should carry out a geol. svy. in the Himālaya, instead of Mālwa, but possibly in view of this marriage he preferred to return to opium dept. in Mālwa, and in Feb. 1823 Herbert was appd. to the Himālaya in his place [268, 457].

1823, appd. Dep. Opium Agent, Mālwa. He appears to have had financial difficulties later, for Malcolm writes; "You are not an old man ; you have rank. You have difficulties ; these you will overcome. Who are without them in this life ? I wish I could give you better comfort, but... you and Mrs. Dangerfield should submit to every privation to pay your debts, for it is them alone will make you miserable"[5].

DARDEL(L), James Colin. Mad. Inf.
b. 17-12-04. d. Anudapuram, 2-5-31, "of jungle fever". MI. Secunderābād.

Ens. 29-9-24 ... Lieut. 8-9-26.

Son of Jacques François Dardell[6] (1773-1805), Bo. Engrs. [II, 393] and Petronella Margaretha Vanspall his wife.

Crofton, II (72).

MPC. 2-10-29, appd. Asst. Survr. Hyderābād Svy. [119-20]. Died whilst out on svy., leaving work in some confusion.

DAVIDSON, David. Bo. Inf.
b. 22-11-04. d. 11-11-71.

Ens. c. 1820 ... Col.; ret. as M Gen. 1861.

Son of Dr. James Davidson, physician, Dunfermline, and Charlotte Johnstone his wife.

m., Bombay, 12-7-47, Mary Caroline, dau. of J. H. Farquharson, Bo cs.

Bo GO. 21-10-24, appd. Asst. to Rev. Survr. in Gujarāt; 1829, to Commt. Dept.; 1850, Commy Gen.

Not to be confused with David Davidson (1811-1900), also Bo Inf., who was Rev. Survr. Deccan, 1837 to 1845, and later, KCB.

DAVIES, Thomas [II, 393]. Mad. Engrs.
b. 7-11-1789. Kd. in action, 18-5-18, Mālegaon, Deccan[7].

Ens. 10-11-09 ... Lieut. 6-4-11-10.

Son of Thomas and Margaret Davies, of co. Denbigh, Wales.

1812-4, Survr. with force under Lt Col. Dowse in S. Deccan [II, 166].

B Pol C. 9-11-16 (25), Elphinstone, Resdt. at Poona, asks for his services as survr., reporting that "Mr. Davies had furnished me with a copy of his Memoir, & has also given me much valuable information regarding the south of the Paishwa's country, and the principality of Sawant Warree[8]. Mr. Davies's surveys & enquiries have been conducted with great zeal and intelligence".

Davies could not be immediately spared, and Elphinstone writes, 28-1-17 ; "The services of an officer of science being just now urgently required for ...the erection of the works...of defence through the Ghauts, I have requested Colonel Doveton [83-4] to send Lieut. Davies to Aurungabad, where he will be employed on that duty by Capt. Sydenham[9]. ... Lieut. Davies will combine an attention to the objects pointed out by the Surveyor General with the execution of the immediate duty on which he is about to be employed. When...the works in the Ghauts shall be completed, ... Lieut. Davies might be very usefully employed in the manner recommended"[10].

Mackenzie later reports that "on Lieut. Davies' arrival at Aurangabad he states that he has no instruments. He was soon after taken ill of a fever, and obliged to retire from... the defence works on the Ghauts, and on 29th April states that the reason of his not applying for instruments from the stores of the forces [was] that they were all spoilt, & observes that they ought to be under the care of those that...could take care of them. ... I sent him a sextant & artificial horizon, which he received on 5th June.

"The troubles...broke out soon after, commencing with 2,000 Mahrattas in the vicinity of Aurangabad a few days before the 29th April [and followed by] the investment of Poonah by our forces on the 8th May [1817]"[11].

Military operations against *pindāris* and Marāthas rapidly developed, and Riddell reports in August ; "Lieut. Davis is anxiously awaiting to receive your instructions. Oliphant[12] is placed under him on survey, and wishes much to have an assistant surveyor also attached to him.

"The object of his survey is the attainment of a topographical knowledge of the country in the vicinity of the Adjuntah ranges of hills [83], principally to the southward of them, as it is in that part...it is intended to have moveable columns of light troops for the defence of the Nizām's Territories on the advancing of our force.

"He wants a theodolite, a circumferentor, and two plane tables. I informed him of the impossibility of sending an Assistant to him, but proposed supplying him with instruments by the first opportunity"[13].

Again, a month later, "Lieut. Davies...expects about 10 officers to be employed on route surveying under him during the advance of the Army. He wishes to be put in General Orders as Surveyor to the Force, and to have the allowances"[14]. He was granted the allce. whilst "under the orders of the Political Agent in Berar, February to October 1817" [350].

From Nov. 1817 Davies became senior Engr. with Doveton's column, recruiting 30 Europeans and 50 Pioneers as Sappers & Miners[15], with whom he performed valiant service till his death. He was wounded in the attack on Nāgpur, 24-12-17. Riddell writes; "You have, no doubt, heard of Davies being shot thro' the body at Nagpore. He had declared the breach practicable & a storming party was ordered. At the head of the Sappers & Miners he

[1] Malcolm (appx., 310-3). [2] DDn. 145 (551), 19-11-20. [3] from Malcolm, 10-2-21; DDn. 191 (101-8). [4] Cochin China, capital Hué, included Cambodia, capital Saigon, and Tonkin, capital Hanoi. [5] HMS. 734 (545), 31-8-82. [6] from birth cert.; original form probably Dardel. [7] 60 m. E. of Nasik. [8] Warree, pls. 1, 24. [9] Geo. Sydenham, PA. in Berār [I, 387]. [10] DDn. 142 (53), 26-1-17. [11] MRIO. M 561, 31-7-17. [12] James Oliphant (d. 1881); Mad. Engrs. Ens. 1814; ret. as Maj. 1838 ; Lt Col. 1854 ; Chmn., EIC., 1854. [13] DDn. 151 (13-7), 3-8-17. [14] ib. (31), 8-9-17. [15] Lake (18).

demonstrated that he was right by going over the breach. He discovered the Arabs not prepared, but he returned *as he was not followed*. He again went with Mr. Bell of the [Blanks] & *again* retired to encourage and bring on the party. It was in vain; while haranguing them, Mr. Bell was killed, & he [Davies] fell shot through the body. ... The [Blanks] are universally accused of having behaved ill. The above is the substance of a letter from Davies" [498].

Davies did not apparently get on with Blacker, who, in his *Memoir* refers to him as "petulant", an epithet that is strongly challenged by Edward Lake[1]; "Lieutenant Davies certainly possessed great firmness and decision, and when called upon as the Commanding Engineer of the Division to give his opinion on points of duty, he did so with that plain speaking and energy which characterised his manly and ardent mind; but assuredly no man was less deserving of the implied reproach of want of temper or manner. ...

"This officer has scarcely left his equal behind him in zeal, perseverance, and activity. His whole soul was devoted to the service. In the presence of an enemy he almost denied himself the necessary support of food and sleep. No difficulty seemed to appal him, and he carried the plans he had formed into execution with a courage and perseverance which deserved success if they could not always command it. When not actively employed, his time was entirely given up to the study of his profession, and to the instruction of his little body of Sappers and Miners.

"His brother officers of the Corps of Engineers have determined to erect a monument to his memory"[2].

In will, dated 10-12-17, left property "to be equally divided amongst my brothers & sisters, except Rs. 1,000 to my servant Frederick—the young boy whom I brought with me from Bourbon"—to be sent to his native island. Also bequeathed 300 Hyderābād rupees to his apprentice Colin McNair[3].

DE BUDÉ, Henry. Ben. Engrs.
b. 3-11-1800. d. Calcutta, 8-11-43.

Ens. 1-9-18 ... Maj. 31-3-40.

Son of Lt Gen. Jacob De Budé and Mary Lambert his wife.

m., 1st., Meerut, 12-7-25, Mary Anne—; 2nd., Miss J. A. Royle; 3rd., Calcutta, 14-4-42, Margaret, dau. of Leith Alexander Davidson [470 n.2].

Hodson, I (36-7).

BGO. 11-3-20, to svy. road Kāshipur to Almora. 1822-3, Nov. 1828, svy. of *doāb* canal Muzaffarnagar to Aligarh [24][4]. Burma War, 1824-5.

1833, comdg. S & M. Delhi.

DE L'HOSTE, Edward Paterson. Bo. Inf.
bapt. 13-8-03. d. 19-7-76.

Ens. 21-2-24 ... ret. as Bt. Maj., 1-10-52;
Hon. Lt. Col. 28-11-54.

Son of Brig. Gen. Solomon De l'Hoste and Sophia Caroline Destrac.

Bo Geo Soc. I (174-83); 1829, survd. Narbáda R. [123]; later with QMG.'s dept. [426].

DE MONTMORENCY, Hervey Francis. Mad. Cav.
b. 20-7-02. d. 8-8-83. Colombes, nr. Paris.

Lieut. 29-7-20 ... ret. as Capt. 17-10-32.

Son of Lt. Col. Reymond Hervey De Montmorency, originally Morres, 13th Lt. Dragoons, of Irish peerage family Mountmorres; bro. to Reymond Hervey De M., Ben. Inf., Hodson, II (45).

Oriental Club.

Burmese War; OC. 22nd MNI. writes, 16-11-25, "Lieut. D'Montmorency of the Quartermaster General's Department, who conducted my march, displayed much gallantry and zeal in this affair, being almost constantly in advance under the enemy's fire"[5].

With Crawfurd's mission to Ava [78, 434].

Jan. 1827, appd. asst. to Grant, who writes that "this officer was employed during the late war in the Department of the Quartermaster General, and from my own knowledge of his qualifications, I am well satisfied he will do full justice to the choice"[6]. De Montmorency worked under Grant in Amherst Dist. [76-7, 455] till 1828, when he returned to Upper Burma, and was emp. by Burney on svy. up the Chindwin to link with Pemberton on the Manipur frontier [78], after which he returned to Moulmein but was not again emp. on svy.

DE PENNING, Joshua [II, 394-5]. Sub-Asst.
b. Chingleput, 9-8-1784. d. Calcutta, 30-3-45.

Appce. 21-6-1798; Sub-Asst. 9-9-05; resd. 1-2-24; reappd. to ch. Computing Office, Calcutta, 1831, serving till death.

Son of Peter De Penning, sergt. of Mad. Art., who m., 24-7-1780, Marie Sicé, of Tranquebar & Pondicherry.

A nat. son, Joseph, born before his marriage, was appd. Sub-Asst. GTS., 1-7-21 [379-80].

m., Pondicherry, 18-6-10, Marie Hypolitte Gill, by whom he had 14 children, of whom George Alfred, b. 1830, had sons conducting business as Patent Agents in Calcutta in 1945. In 1841 he had "7 unmarried daughters and 4 sons, all unprovided for" [471-3].

Aug. 1800, joined Lambton's svy.; from 1812 to 1818, emp. largely on trgn., including that of the great merl. arc [II, 247-8; III, 223-4, 234, 251, 259, 373, 378, pl. 18 n.], keeping up an interesting journal [II, 247 n.4] from which the following further passages may be quoted;

"In June [1818], we removed to the cantonments at Secunderabad, & took possession of a house belonging to Lt Col. Lambton, which he had the goodness to let us have. Messrs. Olliver and Rossenrode also entered the new house which the Colonel had...to build at his own expense.

"The French Gardens[7] will be ever dear to me from the length of time I had resided in it; its romantic situation, but above all from its having given birth to 3 of my children, and where, ... through the bounty of my Maker, I enjoyed a lasting peace & tranquility in the bosom of my dear family for the space of 3 years and 9 months nearly, ... notwithstanding the damp situation of the house I occupied which, from its being in a low spot surrounded with paddy ground, was during the monsoon & cold weather subject to humid exhalations, while water was constantly oozing out from the flooring, the lower part of the walls being also damp ...rendered the place extremely disagreeable for half the year.

"From the time of my arrival at the cantonment to the end of October, we remained in quiet possession of our new house, being under orders to take the field on another expedition to the south [227, 325, 491]. ...

"My little son was taken ill of the dysentery, the first symptoms of which made its appearance at the Gardens. In a short time, whether owing to the change of air or the natural course of the distemper, the child became seriously ill, and we despaired of its recovery. On the day we supposed

[1] (1792-1830/2); m. dau. of John Goldingham [II, 402]; auth. of *Sieges of the Madras Army*. [2] Lake (18-118, *passim*); *ob.* appreciation, GO. GG in C., 26-9-18. [3] Colin Wm. McNair had son Gregory, b. 1832-3, acct. at Ootacamund in 1858. [4] cf. Sandes, II (5). [5] *Govt. Gaz.* 12-12-25. [6] GO., Moulmein, 30-1-27; DDn. 217 (63) & 221 (211) 10-2-27. [7] so called after troops comdd. by Raymond, disbanded 1798 [I, 117]; occupied by Lambton 1815-8.

the child was about expiring I got him baptized by the Brigade Major, ... then officiating Chaplain. ... The child continued seriously ill that day and the following when, to the unspeakable joy of every person concerned, ... a visible change in the disease took place, and the child gradually recovered".

De Penning was in the field again on the s. borders of the Nizām's country during Nov. and Dec. 1818, [8, 227] but remained at hdqrs. during Lambton's absence in Calcutta [228], completing the work round Kurnool during 1820–1 [232]. Whilst out on trgn. he received instrns. from Lambton every three or four days, those of 28–1–21 reading;

"I received yours from Dunnaram last evening when I was sitting down to dine, and I am much gratified to find that you succeeded so well in choosing a station. With respect to your bringing in the whole camp—if it be absolutely necessary, do so—but it strikes me that it will be the cause of delay, and I wish you to proceed to the north as quick as possible, as the atmosphere will soon get so hazy as to prevent your seeing above ten miles.

"The sick at all events can be brought in and exchanged without detaining you here, and you can take the observing tent that belongs to the great theodolite. You will do right in sending forward parties to clear the jungle, but I do not intend you should go as far north as Guckole, but that you will connect that station by intersection. ... You need not look so far as the Godavery. ... I wish to have you all back again as soon as possible, that we may get on with the General Report"[1] [237–9].

In 1821, whilst Lambton marched north to measure his base at Tākarkhera in Berār, De Penning continued the Great Arc to within 60 miles of Ellichpur, work being then held up by sickness [8, 232]. The following year Lambton broke up hdqrs. at Hyderābād, and marched his whole est., excepting those on dett. with Everest, to form new hdqrs. at Nāgpur. De Penning appears to have sent wife and family to Pondicherry before this ill-fated march, but was himself with Lambton at his death at Hinganghāt. He sent the sad news to Everest the next day, and marched the whole camp on to Nāgpur, where they arrd. 26–1–23 [236, 247, 255, pl. 18].

Though now the senior GTS. officer on the spot, De Penning was unable to withstand the forceful assumption of authority by Asst. Surg. Morton, whom Lambton had appd. executor of his private estate, and who proceeded to sell by auction at Nāgpur, not only all the great man's private property, but a number of Govt. articles as well. De Penning warned Everest that Morton "intends to hasten the sale of the Colonel's effects, so that I fear it will take place before I am favoured with any instructions from you, especially concerning the Circular Instrument [257, 259]. In the event, ... I intend taking it up at my own risk"[2].

Everest's reply was insistent that everything possible must be done to prevent such vandalism, and that he was ready to purchase everything himself; "These...reasons must be the foundation of your protest, which you must make on my part. You must strain every nerve, my good Sir, to see that the estate of your late benefactor is fairly dealt by, ... the sale being postponed until the nature of the effects is made known to the whole scientific part of India"[3] [444, 468–9].

But De Penning was not of the stuff to play a strong hand on his own, and Everest's whip arrived too late to stop the untimely sale, from which De Penning bought for himself the portrait which his family sold to the Department in 1902 [467], and a clock[4] which was keeping excellent time in 1938 [260 n.5]. This clock was used by De Penning in the SGO. obsy. after 1836 for regulating the time signals made from Ft. William.

He was not anxious to stay on with the survey under the new conditions, and there appears to have been little sympathy between him and Everest. His young family was increasing in numbers, and the extension of the svy. through the hills and forests of Central India did not promise much for the comforts of family life. He writes to Everest from Nāgpur;

"You have always manifested a sincere regard for every one of us, and, ... should it be my lot to continue on the survey, I shall make it my duty to merit a continuance of your esteem. ... But...my health will not permit me to continue long in this climate, which does not agree with me. I have had another attack of...fever, ... for which I was as usual obliged to go through a course of mercury, and I am at present no better than an invalid"[5].

A week later he made definite request to resign; "In consequence of the attack of fever which I recently suffered, and the return of my rheumatic pains, I feel myself obliged to apply for leave to proceed to the Coast, but under the present anxiety of my mind, owing to some recent calamity in my domestic concerns, ... I shall not be able to return to my duty for a considerable period. ... I may be permitted to retire. ... I have been constantly and actively employed in the field, and from being out in all seasons have suffered...both in health and pecuniary losses".

He pointed out that under the rules of 17–1–07 "a Revenue Surveyor who may have served...twenty years from...the expiration of his apprenticeship shall be allowed to retire on a pension not exceeding the half-pay of his situation" [II, 349], and asked "to retire...on a pension suitable to my services and the rank I hold in society or, if my service be required in any other department, I hope...to hold some situation of...respectability under the Presidency of Fort St. George, that I may have the advantage of being near the Coast.

"In the meantime, I beg...to proceed to Madras, and ultimately to Pondicherry, as my health and private concerns require my immediate presence there"[6].

Everest was indignant that De Penning should wish to resign at this difficult juncture, more especially as he considered him much to blame for Morton's wanton action in selling off Lambton's prof. property, and for not immediately separating all articles that rightly belonged to the Survey [242].

"It will be exceedingly inconvenient...that Mr. De Penning should...depart until the confusion...has been remedied". The SG. commented that De Penning had only recently drawn "sicca rupees 7,911", arrears from 1–1–18, on his promotion to Rs. 400 pm., and Govt. ordered that, though he would be granted any leave recdd. on mc., he would not be released until entirely convenient to the service[7] [326, 379].

Relations were eased by the intervention of Voysey, as he passed through Nāgpur on his return from the north [236, 243], and Everest then wrote to De Penning; "When my operations commence in the latter end of this year, you should proceed in charge of the instruments to Ellichpoor, and from thence take your departure for Madras so as to arrive there on the 1st Feby. Beyond Ellichpoor I will never ask you to accompany me.

[1] DDn. 92 (170), 28–1–21. [2] DDn. 91 (237–8), 24–1–23. [3] DDn. 172 (8–9), 6–2–23. [4] Clock No. 623, by A. Barraud, Cornhill, London [218]. [5] DDn. 91 (245–8), 14–2–23. [6] DDn. 197 (38), 22–2–23. [7] BMC. 23–5–23; DDn. 93 (40).

"I never had the slightest wish to oppose or injure your views—never beyond what my duty required of me have I thwarted you in any respect— ... but I should think it unnecessary to remind a man of your good sense of the ill appearance it would wear if, after having served with so much credit and honour to yourself in prosecution of a great national work like this, you should suddenly cease to feel an interest in its success, and out of pique or caprice withdraw your interest when you are most wanted.

"Consider the extreme embarrassment your departure would occasion, for since Mr. Rossenrode's quitting Nagpore (and in justice his leave could not be denied him), who is to take charge of the instruments and records belonging to the Survey? Who is to communicate to me the exact state in which the calculations and all other affairs have been left? Either then I must taken a journey of 620 miles to Nagpore and back, or the whole establishment must be removed here, at vast expence and trouble, in order to be again brought up at the end of a few months [233, 243]. ...

"When the time arrives at which you are destined to leave the Survey, I will do everything in my power to make your retreat both honourable and comfortable"[1] [380].

At the same time Everest wrote privately to the SG.; "I am very sorry to part with him. ... I...think that Mr. Goldingham would be glad to employ him in the Observatory, and that he would have no objection to the situation, provided it could be made worth his while. A person of his practical efficiency should not be lost to the service"[2]. Officially he records that "Mr. De Penning has risen from obscurity entirely by his own merits. Self educated, he has by his own exertions made himself an excellent practical astronomer, and is at this time elegantly skilful in the management of instruments, in the application of formulæ, and in all the practical parts of calculation and observation connected with this Survey"[3] [378–9].

Elsewhere he describes the hesitation of the humbler members of the staff to continue service after Lambton's death; "The feeling on the part of these poor people was not bettered by the example of Mr. De Penning who—now that he had made what was to him a fortune in this department, and had received a very great increase of salary, with five years arrears, ... on the very plea of enabling him to proceed as far as Agra—...declared his intention to resign.

"This person...was possessed of a vast deal of shrewdness, and was exceedingly clever in the management of instruments. He had joined Lieutenant-Colonel Lambton... in very boyhood, and attended him in all his operations in the Deccan and had fallen into all the Lieutenant-Colonel's little ways and, as the venerable old man declined in intellect and energy, had assumed the absolute mastery of the office, and all the arrangements of the...Survey [237, 443].

"I had always been very ready to do justice to Mr. De Penning's merits, ... under proper surveillance; but I was not prepared to leave either him or any other person, to carry on, uncontrolled, operations so deeply involving the reputation of the work entrusted to me [234, 252]. But his loss was very severely felt; not only because he was, when well looked after, highly capable and useful, but because he had acquired over the native followers that influence which...is sure to be engendered by superior wit and intelligence"[4].

De Penning readily gave in, and apologised for having been so insistent. He stayed on in Nāgpur for the rains, and brought his party down to Tākarkhera in November, to complete most of the recce. by the time Everest arrd. He writes on 19th Nov. "I am really glad we shall meet before the 25th, for I am heartily tired of my exilement, and do sincerely hope to see you perfectly restored to health" [244, 444].

After assisting with the meast. of the base, he was released from 1st Feb. 1824, and allowed full salary to cover his journey to Madras, where his services were replaced at the disposal of the Madras Govt. [9, 245]. He was granted pension of 22½ *ps.*, to which he was entitled under Madras rules, disregarding the increase of salary that had been allowed under the Supreme Govt. He was re-emp. by the DSG. in the Madras office, on salary 45 *ps.* in addition to pension. This was converted in 1830 to a total of Rs. 167–8 including pension[5] [321].

After his return to India Everest called De Penning back to the GTS. to become Chief Computer, a post he held at Calcutta from 1831 till death [435, 491].

DICKINSON, Thomas [II, 395]. Bo. Engrs. b. 16–4–1783. d. 19–4–61.

Ens. 21–9–1798 ... Col. 14–6–42 ret. 10–5–43; Hon. M Gen. 28–11–54.

Son of Thomas Dickinson, paper manufacturer, and Frances his wife.

m., Bombay, 14–4–08, Catherine, dau. of M Gen. Josiah Dean; g. father of Willoughby Hyett Dickinson (1849–1943), cr. 1st Baron Dickinson, 1930.

1812–21, Rev. Survr., Bombay & Salsette Is. [6, 167–9, 392]; 1817, on svy. of Bassein [128].

1820, James Welsh records that on visit to Bombay, "on 27th Feby. I removed to the house of Capt. Dickinson of the Engineers, from whom I had received an invitation and who, with his lady, kindly put themselves to great inconvenience"[6].

1820, raised company of Sappers from existing Engr. lascars for expn. Persian Gulf[7]; Bo. GO. 7–5–21, appd. actg. Supdg. Engr., handing over rev. svy. to Tate [343].

Later became CE. till retirement.

DOWELL, William Wanklyn. Bo. Inf. bapt. 3–4–1797. d. at sea 28–6–33, on voyage home.

Lieut. 19–1–19 ... Capt. 10–6–31.

Son of John Dowell, hat manufacturer, Bristol.

Bo MC., camp, 1–3–24, appd. Asst. Survr.; Bo GO. 22–3–24, being originally appd. to supd. svy. of N. Konkan, was posted to S. Konkan under Thos. Jervis [127, 130] "to obtain a more perfect knowledge of his duties".

Bo GO. 13–2–26, tr. to rev. svy. Ratnāgiri to work for Collr.; prepared "Memoir of survey of part of Rygurh Talook" [173]. Appt. to svy. dept. ceased from 31–5–30, but continued on rev. assessments under Rev. Comnr., Deccan. 1832–3 emp. on examination of Pringle's rev. svy. of Poona [172] till departure on furl. 6–6–33[8].

In *History of the Mahrattas*, Grant Duff includes sketch of mausoleum at Bijāpur by Dowell, and regrets that he could not include two other drawings "executed with admirable fidelity and precision"[9].

DOWN, James Sommers. Bo. Inf. bapt. 11–6–02. d. 25–9–71.

Lieut. 4–5–20 ... Lt Gen. 25–6–70.

Son of James Down of Deal. ed. Eton c. 1817–20.

1–8–22, submitted map of Rajpipla[10] to Resdt. Baroda, "having been for some time past engaged in making a

[1] DDn. 172 (49–51), Hyderābād, 28–5–23. [2] DDn. 171 (28), 27–5–23. [3] ib (22), 28–5–23. [4] Geo. Everest (33–4). [5] DDn. 202 (101), 8–4–25; 236 (204), 1–2–30. [6] Welsh (161); Cadell (164). [7] Expn. under Col. Warren, HM. 65th Ft.; Feb–March 1821, Dickinson mentioned in dispatches *As J.* 1821 (372). [8] Bo RC., Camp, 517/1833. [9] *History of Mahrattas* I (frpce. & pref.). [10] S. of Narbada R. [II, pl. 15; III, pl. 9], DDn. 278 (31).

map...of Rajpimpla, an undertaking I was...to attempt in consequence of the blank upon existing Indian maps of this...principality. ...

"It would be presumptuous in me to...claim to more than tolerable accuracy in fixing the position of the several districts and villages of Rajpimpla, ... being my first attempt at anything of the kind. I was destitute of all aid from instruments, and even of the perambulator you had the kindness to send, the same having been rendered unserviceable by an accident before it reached me.

"The country...presented...great difficulties, the most part of it being overrun with a thick jungle, roads blocked up, and many villages deserted. The hill pergunnahs especially, from their all being nearly waste, and nearly impenetrable, and it was not until very lately that any road whatsoever was opened and which, though now merely consists of a footpath, I have nevertheless endeavoured to lay it down as correctly as possible. ...

"Another cause which operated strongly against my visiting the hill pergunnahs just at this time was the unsettled state of their country, fearing that my presence there would excite some apprehensive jealously in the minds of its savage inhabitants, the Bheels [II, 168 ; III, 123]. ...

"The want of proper instruments...must have occasioned some errors, but I hope, from the trouble I took to gain correct information in the several districts, that the inaccuracies will not be found very great. The Boundaries to the N., S., and W. are laid down from a map of the late Surveyor General's ; ... to the E. is from native information. The principal towns, likewise, in the British territories are also from thence"[1] [129].

Sutherland thought the map "to have been copied from the late General Reynold's map, with the exception of some villages...to the south of the Nerbada River, and a route...to Kookurmoode on the Taptee, the accuracy of which I am unable to report upon, as neither field book nor journal has accompanied the sketch. There are also a few villages among the hills between the Narbada and Taptee rivers which I rather think must have been inserted by information, and not from actual survey.

"The execution...is very creditable to Lieut. Down, both for neatness and distinctness of delineation, and shows him to be possessed of considerable talent"[2].

On the strength of this svy., Down was appd., BGO. 27-11-22, Asst. on rev. svy. of Gujarāt, and was still emp. in 1828[3] [170 n.5].

Served in 1st Afghān War, and occupation of Sind; comdd. 1st Grenadiers 1840-52.

DRUMMOND, John Gavin. Ben. Inf.
b. 26-8-1788. d. 11-12-51, Khāriān, 10 m. SE. of Jhelum.

Ens. 25-1-08 ... Lt Col. 20-12-43.

Son of J. Drummond, of Edinburgh.

m., Euphemia Farmer.

CB. Hodson, II (87-8).

Sept. 1822, appd. to QMG's Dept. for svy. of communications, survg. roads through Mirzāpur and Rewah and to W., till recalled on outbreak of Burmese War [27].

1825, AQMG. Arakan [69, 337]; April, "reconnoitred road by which the Burmese Chief, Bandoola, and army fled from Arracan. He traced them through 22 miles of mountainous country covered with thick jungle, and sent 5 hircarrahs further on, returning himself"; assisted Crommelin with map [69, 435, 501][4].

DDn. 401 (250), 29-1-43, on svy. Agra-Bombay high road; in QMG's Dept. till death.

DUMARESQ, Edward. Bo. Inf.
b. 10-6-02. d. 23-4-1906, aged 103, Mount Ipeh, Hadspen, Tasmania (the residence of his son).

Lieut. 30-12-18 ... Capt. 8-9-25; ret. 25-4-27.

Son of Col. John Dumaresq, of Swansea, and Anne Jones his wife.

ed. RMC., Sandhurst.

m., 7-11-27, Frances Blanche, dau. of Michæl Legge, of Garrane, co. Tipperary.

Burke's *Colonial Gentry*, I (330) ; *Times*, 25 & 26-4-1906.

Bo GO., 4-3-20, appd. to rev. svy., Gujarāt from 1-3-20 ; ib. 12-6-23, leave to sea on 8 mo. mc.; Sept. 1824, at capture of Magannah, Gujarāt ; Bo GO. 21-10-24, absent on mc. ; 25-11-24, furl. to Europe, for health [170 n.5].

Emigrated to Tasmania, settling at Mount Ipeh, with residence at St. Heliers, East Kew, Melbourne; Magte. of Tasmania from 1828.

DUN, George. Mad. Inf.
b. 5-5-1787. d. Chicacole, Ganjam, 18-4-20, "of fever from zeal and fatigue"

Ens. 27-6-06 ; Lieut. 15-1-07

Son of James Dun, of Shaw Park, nr. Selkirk, and Jean Anderson his wife.

27-2-20, left Nāgpur on route to Calingapatam, a port on Ganjam coast; journal amongst route svys. from office of DQMG. Nāgpur State Forces[5].

DU VERNET, James Smith. Mad. Inf.
b. 26-4-03. d. 2-11-72.

Ens. 2-5-23 ... Capt. 31-10-43; Bt. Lt Col. 4-11-56; ret. 21-4-57, Hon. Col. 29-5-57.

Son of Lt Col. Abram Du Vernet, RA.

m., Truro, 20-8-38, Eliza Lavinia, dau. of Benj. Martindale, of Brunswick Sq., London ; she d. 6-4-88, aged 70.

"I was appointed a cadet in May 1823, and in March 1824 arrived at Madras, after a voyage of nearly eight months [419]. On my arrival I was ordered to do duty with the 45th regiment N.I., which I joined at Amree, and in May was posted to the 24th regiment N.I. at Vellore. ... I subsequently marched with the regiment to Bellary, and then in 1827 we went to Kolapore to relieve the regiments there stationed after the taking of that place.

"In February 1828 I was appointed to the provincial survey of Malabar, with which I remained until 1830, and took part in surveying the districts of Malabar, Madura, Trichinopoly, and part of Tinnivelly"[6].

MGO. 12-2-28, appd. Asst. Survr. from 5th ; joined Malabar Svy. 13-4-28 ; 27-10-29, reported as "a zealous and valuable surveyor" [114, 342].

MGO. 6-11-29, services replaced at disposal of C-in-C., on which the DSG., Montgomerie, made successful protest against "the irreparable loss which the Survey Branch would sustain. ... Lieutenant Du Vernet, having gone thro' a regular course of studies for five years under the professors of the Royal Military College in England, was found particularly well qualified for employment in the Survey Department. ... Captain Ward...has repeatedly reported most favourably as to his superior abilities and zeal"[7]. Govt. agreed that he might remain with the Survey to understudy Ward, "whose health was much impaired"[8].

[1] Bo MC., Camp, 59-1822 (207-9). [2] ib. (215-6) ; Poona, 26-10-22. [3] Bo RC. 737/1836-9 (11-2). [4] *Govt. Gaz.*, 2-6-25. [5] MRIO. M 220 ; *v.* DDn. 223 (24), 28-3-25. [6] to SG. 17-3-41 ; DDn. 435 (11-4). [7] DDn. 236 (143-7), 7-11-29. [8] MPC. 10-11-29 ; DDn. 236 (151).

Except for break between 1836 and 1840, Du Vernet remained with Svy. Dept. till 1854, becoming one of the best topo. survrs. of the period. From 1840 with GTS., holding ch. of Himālayan parties for several years [209].

DYSON, Henry Wilcocks. Ben. Inf.
b. 15-9-1793. d. 20-12-18, Dungarpur, Rājputāna.

Ens. 19-3-10 Lieut. 10-12-14.

Son of Rev. Henry Dyson ; ed. Charterhouse.

Hodson, II (114).

Marātha War, made svys. of which Malcolm writes from Mhow ; "The importance, and indeed necessity, of gaining a fuller and more correct account of the countries of Pertabgarh, Bhauswarrak, and Donjerpoor, and other petty States in that direction, made me anticipate the Governor General's approbation to the employment of Lieutenant Dyson...on this service.

"I had, when in Mewar [Udaipur], become acquainted with the efficiency of this officer, who adds to that science necessary for a surveyor, general acquaintance with the native languages, and particularly Sanskrit. These acquirements, combined with good temper and considerable knowledge, pointed him out for such a duty. I have placed him in the Intelligence Department, ... but I also expect to derive much benefit from his geographical labours, and from his researches into the History of the ancient and modern Hindoo institutions.

"Lieutenent Dyson...on 20th June was on the point of proceeding to Banswarre. ... I...transmit a very full and satisfactory memorandum he has forwarded to me respecting the petty State of Pertabgarh"[1].

Appd. 7-11-18 "to survey the countries of Purtabghur, &c". ... Mackenzie reports, 16-1-19, "poor Mr. Dyson's death, whom I knew in 1814, & had anticipated great expectations from his zeal and talents. "Sir John Malcolm had, of 5th November, forwarded me a letter of my friend Mr. Dyson's with some inscriptions & translations"[2].

ELWON, Thomas. Bo. Mar.
b. 1793-4. d., 17-6-35, at Bassador, or Basidu, Persian Gulf.

Mdpmn. 16-9-10 ... Capt. 26-12-32.

Low, II (70, 109).

An experienced survr. ; 1822, survd. Narbada R. [123]. 1829-32, comdg. survg. ship *Benares* ; 1833 till death, Commodore in Persian Gulf ; bur. under dining table in Commodore's house at Basidu.

EVEREST, George [II, 396]. Ben. Art.
b. Greenwich[3], 4-7-1790. d. 1-12-66.

Lieut. 4-4-06 ... Lt Col. 7-3-38 ; ret. 16-12-43 ; Hon. Col. 28-11-54.

STS. 1823-43 ; SG. 1830-43 [1, 2, 301].

2nd son of Wm. Tristram Everest, solicitor, of Greenwich, and Lucetta Mary his wife ; bro. of Rev. Robt. Everest, MA. Oxon., and army chpn. India.

ed. RMC. Marlow and RMA. Woolwich ; appd. cadet, EIC., at age of 13[4] ; nominated to RMA. 1-8-04.

m., 17-11-46, Emma, dau. of Thos. Wing, barrister of Gray's Inn ; his eldest and last surviving son, Lancelot Feilding Everest, d. Hampstead, 1-4-1935, in his 82nd year, and has left interesting bio. memo., freely quoted here under ref. LFE.

FRS.[5] 8-3-27 ; FRAS. ; FRAs Soc. ; FRGS. ; FRIGB. ; CB., 26-2-61 ; Kt., 13-3-61.

DNB. ; *DIB.* ; *Ency Brit.* ; Markham (68-80) : *RAS* (*mn*). XXVII (104-8) ; *JASB-P.* 1868 (25-6) ; *RGS-P* XI, 1867 (185-8) ; Hodson, II (145) ; LFE. (*sup*)[6].

Auth. of *Account of the Measurement of an Arc of the Meridian.* London. 1830 ; *Account of the Measurement of two sections of the Meridonal Arc of India,* London, 1847 ; *A Series of Letters addressed to H.R.H. the Duke of Sussex,* London, 1839.

Of his early life in India, where he arrd. 1806, his son tells of two incidents narrated to him as a boy ; "He was out at a party one evening and won a considerable sum of money at cards. On his return home, he resolved to discontinue that sort of thing altogether. So he opened the window of his room, and threw out the whole of the money he had won, ... and never played for money again. ...

"On one occasion he rode a horse into a...considerable depth. He was unhorsed, and nearly drowned, being at that time unable to swim. He underwent all the sensations of being drowned, and became of course unconcious. He was, however, restored to consciousness and to life. The horse itself was drowned. After that he immediately took lessons in swimming"[7].

1812 or 1813, to Java on regtl. duty; 1815-6, on svy. and recce. in Java [II, 137-8] ; returned Calcutta 20-11-16 [500].

BTC. 21-3-17 (3, 4), appd. from 1st Batt. Art., to clear Nadia rivers of obstructions [15] ; B to CD. (rev), 4-7-17 (137-46), "It appeared that the navigation of the Issamutty and Matabanga streams[8] was seriously impeded. ... The obstructions...were occasioned by the trunks of trees or sunken boats, which had got imbedded in the channel of the stream, and which it had not hitherto been found practicable to remove.

"The rapidity of the stream, and the great variation in it's depth at different periods, ... render it difficult...to mark the situation of these obstructions by means of buoys, and these would at best afford a very insufficient security against the danger. It was suggested to the Governor General that the entire clearance...might be effected at a moderate expense...by applying as the force for raising the trees or vessels...the buoyancy of boats made fast to them by cables.

"We accordingly appointed Lieutt. Everest, of the Artillery, with whom the above suggestion originated, to superintend the work. The operations...have been entirely successful, and...he has removed every obstruction...in the whole course of the streams...from the Great Ganges to the Hooghly River. The total expense will not...exceed 2,250 rupees, exclusive of the...allowance assigned to Lieutt. Everest, and the value of the public stores expended. ...

"We have instructed the Collector of Nuddea to adopt measures for the removal of all trees growing on the banks of the canal which may appear likely hereafter to fall into the stream, and we may therefore hope that the necessity of repeating the operations...will not recur. ... In any case, however, the principles adopted by Lieutt. Everest will probably be found to admit of easy application".

Unfortunately the cure was no permanent one, and an officer was appd. "Superintendent, Nadia Rivers" [15, 312].

Everest's svys. in Java and work on the rivers marked him out for further empt., and, under BGO. 21-10-17, he was appd. to svy. a line for visual telegraph towers to connect Calcutta with Chunār [270-1], and at the same time was selected for the very important post of Asst. to Lambton on the Great Trigonometrical Survey [497].

"The intense mental and bodily labour of conducting the Trigonometrical Survey has been performed heretofore by Colonel Lambton alone, and...the rank, and the advancing age, of that zealous and distinguished person now demands some relief from such severe fatigue. ...

[1] DDn. 133 (489-91), B Pol C. 7-11-18. [2] DDn. 154 (63). [3] Not b. at Gwernvale, co. Brecon, as stated in *DNB.*, Hodson, etc. *v.* regr. St. Alfege ch. Greenwich ; and census return 1861. [4] IO. Misc. 43 (162). [5] proposed by Kater [II, 410-1]. [6] Portraits will appear in vol. IV. [7] LFE. (27). [8] connecting Ganges with Hooghly.

"The mathematical qualifications for conducting such labours are of a very high order, and possessed by few in India; they require to have been kept up by habitual exercise. ... The extreme accuracy indispensable in trigonometrical calculations on the scale of Colonel Lambton's undertaking demand a dexterity in the use of the instruments...which is to be learnt only by a rigorous apprenticeship. The regretted time must one day arrive when Lieut. Col. Lambton's task must devolve on a successor. It would not be wise to trust to chance for producing one fully equal to the duty at the moment when he is wanted; neither is it right that this important survey should thus hang on the life of a single individual. ...

"The Governor-General, therefore, has selected for this office Captain Everest of the Artillery, of whose eminent degree of science as a mathematician he is assured, and whose talents are known, ... both by his surveys in Java under the Quarter Master-General's Department, and by his successful exertions as an Engineer in recently clearing the navigation of the Matabhanga and other rivers. ... Captain Everest should [not] be abruptly taken away from the useful service...under the orders of the Telegraphic Committee but, as soon as that officer... has reached Nagpoor, he may...proceed onwards to join Lieut. Colonel Lambton[1] [8, 225, 342, 447]".

Everest makes a curious claim to private property in some of his work on the telegraph line;

"I took a route of the tract between Rotas Gurh and Punnoogunge near Bijeygurh in 1817[2], which is perhaps as accurate as route surveys in general. It was plotted very carefully by me from my field book, but as it was entirely extra-official work, and taken for my own amusement, I destroyed the field book as useless lumber.

"The original, being my private property, I lent to Col. Blacker for the purpose of facilitating the operations of my own people under Mr. Olliver in 1825 [261–2], and I found it had been registered amongst the public documents, and called for by the Court of Directors"[3].

May 1818, the telegraph svy. reached Chunār where Everest spent the rains. He left in Oct. for Hyderābād, making a svy. of his route, which he submitted to Govt. in 1840 describing how, "having nothing else to occupy me, I employed myself in taking a route survey. ... The field books were drawn up with great care, and...I offered the materials for the acceptance of the Supreme Government. ...

"The Surveyor General of the day, Colonel Mackenzie, ... did not avail himself of my offer, and the materials remained in my keeping until my return from England in 1830, shortly subsequent to which I put them into the hands of the head draftsman of my office, Mr. Graham [313]. ... The field books and other materials were still not only as intelligible as when first drawn up, but rather good than otherwise of their kind. ... This compilation map was unfinished at the time I left Calcutta in 1832–3; in fact it did not reach my headquarters in the field until November 1838. It was neatly executed when it arrived but, owing to one of those accidents against which it is impossible to provide, ... it received an injury in consequence of the bad soldering of the tin case enclosing it [358]. ... With the injured parts patched, it is now forwarded to His Lordship"[4] [352–3].

Arrd. Hyderābād 26–12–18; took the field 8–1–19 for instrn. by Lambton, and remained out in company with Voysey till April [227–8, 466]. In June he set out to trgte. the E. part of Nizām's dominions between Kistna and Godāvari. Extracts from his vivid account of the difficulties of this expn., through weather and sickness, have already been given [8, 228–32, 265]. He started by having trouble with the guard of State police;

"These people most heartily disliked the expedition... and seized every pretext of skulking away from the camp and back to the city. My representations...were answered by Colonel Lambton with a desire, both on his part and that of the British Resident, that I should seize the first feasible grounds for making an example. ...

"The infliction of corporal punishment is an odious task; but in this case there was really no choice between that and giving up the operations. Urged, therefore, on one side by my superiors, and irritated on the other by the total disregard shewn, ... I took an opportunity about a month after leaving Hyderābād to chastise one of these defaulters with some severity; in consequence of which the whole body, about forty in number, burst into open mutiny, seized the native gentleman whom the minister had deputed as their chief, and declared they would quit my camp and carry him back with them.

"It was in a grove of mangoe trees surrounded by a ditch and bank that they had selected their spot of encampment. There sat the Daroga (headman), surrounded by the mutineers, some with their swords drawn, others looking on. ... It...became my duty to assert my authority, or give the matter up entirely as hopeless.

"With the Great Trigonometrical Survey of India there has always been an escort of regular sepoys...not belonging to the standing army [II, 359; III, 406–7]. Colonel Lambton had detached twelve of these under my orders. ... I drew up a small party of eight men with loaded muskets in front of the grove where the rebellious Juwans[5] were lording over their superior, and declared my intention of firing a volley into the midst of them unless they immediately laid down their arms. Their resolution quailed before this decisive step, and they now became as meanly humble as they had been before audaciously insolent. So, having deprived them of their weapons, and placed them under the surveillance of my sepoys, I made a severe example of three of the principal offenders by publicly flogging them and turning them out of camp with ignimony. ...

"Threats of vengeance buzzed around me for some weeks after this occurrence, and it was necessary to be armed and well prepared to resist assault on my person. But the natives of India are not a malice-bearing race and, finding when they knew me better that good behaviour was a perfect security against all unkindness, they became at last as willing, obedient, and obliging as I could desire"[6].

It was Lambton's regular routine that fd. work should carry right through the rains, in order to take advantage of the wonderful visibility of the occasional breaks. This policy not only exposed everyone to the ravages of malaria, but caused delay through rain, cloud, and mist.

"In those gloomy days", writes Everest, "when the mists descend and obscure the horizon, it was the chief relaxation of Mr. Voysey and myself...to employ all our followers with handspikes and ropes in tearing off the loose masses of granite, and letting them find their way to the bottom of the hill. Certain it was a magnificent spectacle to see an enormous mass, seven or eight feet high, descending along the slippery side of the spheroid, and striking fire in its progress—yet cautiously at first, and as if afraid to venture—suddenly, when it met with some hindrance, it would bound up and roll over like a planet in free space, and, lastly, when it attained the limits of the jungul, it would tear down large trees, and make the welkin roar again as it tumbled into the abyss below.

"Doubtless all this may be very childish, but...the French academician, De la Condamine [II, 469]...and his companions

[1] DDn. 171 (248–50); BMC. 25–10–17. [2] SGO. copy, 1831, MRIO. 81 (37–9). [3] DDn. 267 (169–73), Nov. 1832; with instrns. to Waugh & Renny. [4] MRIO. 63 (10–6), SGO. copy, 1832; DDn. 402 (23–4), 17–4–40. [5] *jawan*=a young soldier. [6] Geo. Everest (7–8).

resorted to precisely the same methods of amusing themselves. ... We did not continue this pastime during the night for fear of injury to my followers; but if our amusement was by accident prolonged a little beyond twilight it is inconceivable how grand the sight became, for wherever the rock slid along the bare side of the hill it was accompanied by a dense train of such enduring sparks as we see emitted from the impact of the hoofs of the pampered coachhorse on the London pavement; and the light emitted when it struck any obstacle was sufficient to enable us to trace its progress, and make it resemble a whirling mass of phosphoric matter"[1].

Work was proceeding steadily in spite of the weather when, in October, the whole party was overwhelmed with malaria, and had to retreat to Hyderābād, leaving 15 dead behind them [231–2, 402]. In June 1820 they took the field again to complete trgn. to the Godāvari, but after a few weeks Everest was again down with fever and, leaving his assts. to complete the work, he took sick leave to the Cape for 12 months [232–3, 396–9][2]. He sailed from Madras 1–10–20 and, submitting a further mc. from Port Elizabeth, 2–6–21, was back at Madras 31–12–21, and rejoined at Hyderābād 6–2–22 [233].

Whilst at the Cape he spent some time, at Lambton's request, examining the merl. arc measured in 1750–2 by La Caille[3] [I, 310]. His memoir on the subject, dated Capetown, 31–8–21, was sent to the Astrl. Soc.[4] through the Directors, with copy to Lambton, who forwarded it to the GG.; "I have examined it with great attention, and I find the particulars so well detailed, and the observations so just. ... He has fulfilled my wishes in a most masterly manner"[5].

Everest notes to the Directors; "La Caille's geodetic operations at the Cape...are particularly important from their furnishing the only data...respecting the compression of the southern hemisphere. We have...meridional arcs...in the northern hemisphere, but all leading to results very different from those of M. De La Caille, and the most splendid of these...is beyond doubt that which owes its origin to the patronage of the Hon. the East India Company. ... If the effects of climate do not blast my prospects, I look forward to...taking an ample share in the measurement of the arc now in progress towards Agra and Hardwar".

To Lambton he writes, 31–8–21; "I arrived in Table Bay on 25th November 1820; no information could be obtained on the spot, and it was not till the end of June 1821 that a journal of De La Caille's travels reached me, so that by the 26th July I was enabled to visit the places described...and traverse the whole theatre of his labours".

He identified all La Caille's stations and the extremities of the base-lines—compared these against the diary—and actually found someone who remembered the signal fires to which La Caille obsd. He points out how these obsns. might have suffered in accuracy, that the two extreme stations might have been influenced by local attraction, and that the arc was far too short to be taken seriously in discussions of the figure of the earth. With some modifications, his views were corroborated by Maclear who undertook the verification and extension of La Caille's arc some 20 twenty years later[6], and records that interest in it had been "mainly kept alive by the inquiries of Capt. Everest".

From Hyderābād Everest marched straight on to join Lambton at Tākarkhera, near Ellichpur, but was much disappointed to find him packed up ready to return [233], and not being equipped for independent work was obliged to retrace his steps to Hyderābād also. He spent the next six months with Lambton, of whom he has left a striking account [233–4]. The great master was now close on 70 years old and, without realising it himself, was mentally and physically worn out. Everest was deputed to run a new series of triangles towards Poona and Bombay, and was delighted to be given an independent task on which he could exercise initiative, and break away from Lambton's routine, with much of which he disapproved; "I parted from him", he writes, "on the 15th October 1822, and shook him by the hand for the last time. Certain trivial circumstances had combined to ruffle that perfect cordiality which had existed between us in 1818, attributable, doubtless, to faults on either side; but we entertained the most thorough mutual esteem and respect for each other, and having, in compliment to me, made my operations entirely independent of his authority, he left me to act according to my own judgement [9, 234–6, 413–4]. ...

"These western operations...glided on so calmly and agreeably that they were rather a source of amusement and pleasure than of toil or hardship. ... I was challenged, ... and now fairly pitted against one whose name had been sounded by fame's trump in every corner of the learned world. My pride, too, was roused by the reflection that my opponent, who could not enter the field but by proxy, should make any question between me and his agent, Mr. De Penning [379–80, 437–9], and I determined...to make him do me justice by fairly distancing his party in the race"[7] [246–9].

One of his last letters from Lambton was written from Bolarum on 9–12–22, just before the great man started north on his last journey; "My dear Everest, I am glad to see that you are getting on so well through a difficult country. ... Take things quietly and do not harass anybody. I am happy to hear, in all your sickness, that the sub-assistants[8] continue well. Take great care of them, for they are precious materials, and I hope they endeavour to do their best to please you"[9].

Work was proceeding well when, on 3–2–23, belated news came of Lambton's death, and it became Everest's first concern to try and save his personal and prof. property from dispersal through the hasty and ill-considered sale. His efforts were unavailing, and he reports, 27–2–23; "I yesterday received information...that, without waiting for any reply from me, the Executor, Mr. J. Morton, ... had taken upon himself to dispose of the whole of the late Lt.-Col.'s property at an ordinary outcry, and had, to complete the climax, carried away...to Hyderābād all the public documents [242, 438].

"The estate of this late venerable and highly esteemed old officer has been sold off for about one eighth of the price which it could have produced if fairly dealt by. ... But the private loss...is trifling in comparison with the injury which has been inflicted on the public, for amongst the public papers are the official plans and mss. and all the records and data of ...this immortal, national, work for the last 23 years. I am now on my way to Hyderabad to meet Mr. Morton, and try how far I can...remedy this cruel calamity. ...

"At the time of the melancholy event, I...had advanced as far as the neighbourhood of Sholapoor. ... I gave to Joshua De Penning...most positive instructions respecting the public property, and...thought it better to take advantage of the few

[1] Geo. Everest (13). [2] MGO. 19–8–20. [3] Bio. Note, *Phil Trans.* (abbr.) XI (472), deputed by the French Academy of Science. [4] granted royal charter 1831. [5] Account of work at Cape, Gill (v, ci–ii); Gore (116–9). DDn. 92 (219) & 171 (256), 3–9–21 & 9–4–22. [6] *MAS.* I (255–8, 261) 1825; *RS Progs.* XVI, 1867–8 (xii); Maclear, I (1–20). *GTS.* I xxxi). [7] Geo. Everest (25–6). [8] Olliver & Joseph De Penning. [9] DDn. 92 (25–33).

remaining days to carry on the operations on which I was engaged [129–30].

"The intelligence of this cruel blow has come on me like a thunderstroke, but the instant I received it I wrote to Colonel Boles, and to...friends at Hyderabad, to use their efforts to save the wrecks of the public property from the precipitate measures of the executors, in whose hands it is impossible to say what they may have suffered"[1].

He arrd. Hyderābād on, or shortly before, 11th March, and began acrimonious corr. with Morton regarding surrender of official papers and insts., which Morton claimed had been formally handed over to him as the executor on the spot. Morton consented to the papers being examined by an officer of the Resident's staff, and eventually surrendered those declared to be official. After protracted corr. lasting to the end of June, Everest expressed himself satisfied that he had recovered all official papers, but there remained many articles of private property which he felt ought never to have passed to outsiders[2]. He made further ref. about these to the SG., and corr. continued with the executors in Calcutta as late as Jan. 1825 [242, 469].

It was characteristic of Everest that he grew very heated over the whole business, and wrote many intemperate letters, being particularly severe with De Penning for not having taken a stronger line with Morton. He records that this "vexatious correspondence...was only put a stop to by the interference of the British Resident, Sir Charles Metcalfe, in my support"[3].

The business took up much of his time and in writing to the SG., 18-8-23, he asked for an early answer "so that I may have full leisure to reply before the 10th October next. After that date I shall not be able to enter satisfactorily into the subject without neglecting my active operations in the field, during which...it is highly necessary for me to keep my mind perfectly abstracted from all other matters, and totally free from care and anxiety of every kind"[4].

Prompt orders had been issued in India, 7-3-23, apptg. Everest as Supt. of the svy., but at the same time placing him under the orders of SG. [240].

He remained at Hyderābād working on compns. of his trgn. to westward, and on plans for extension of Gt. Arc northward till towards end of August he had a fresh attack of fever, this time accd. by rheumatism and partial paralysis, which made him a semi-cripple and troubled him intermittently for the next two years.

The doctors urged him to take leave at once, "and one of them, a very kind and affectionate friend...Mr. Wynne Peyton [494 n.11], with an earnestness which I shall never forget, strongly pressed me to consider the folly of persisting in an undertaking in which I must assuredly fall a sacrifice[5]. He was, however, determined" to carry his programme through, especially as he would have Voysey's company, and he writes, 3-10-23; "I have for the last two months been suffering much from ill-health, and at this moment am confined to my bed with severe rheumatism. This disorder may perhaps leave me before I reach Ellichpoor but, should it not, it will be of infinite importance to have a man of Mr. Voysey's talent and practical acquirements ready at hand as an assistant, to perform the duties in case of my being rendered incapable [244, 402–4]"[6].

He was sufficiently recovered to leave Hyderābād, 18-10-23, in company with Voysey, and, after starting Olliver on the trgn. where it had been left nearly two years before, he went on to meet De Penning at Tākarkhera, and with him and Voysey remeasd. the base, and made the obsns. which Lambton had been unable to finish [234].

Here he lost both Voysey and De Penning, who had decided to resign, the former because he could no longer carry on with the salary allowed, and the latter because his growing family compelled him to seek a settled life at Madras [380]. Everest had to push forward the great merl. arc, on which so much depended, right through the difficult, heavily wooded, mountains of Central India, with only two competent assts., Olliver and Rossenrode [491].

His health was by no means recovered, and in a fit of depression he applied for leave on mc. [403]. He asked for leave to travel to Bombay on duty, reconnoitring for the extension of his western series, and then to take a sea voyage round to Calcutta. Olliver was to carry the work across the mountains, and Everest would rejoin the other side. His condition improving, he pushed on with the work, writing, 17-2-24; "to recall my application for leave of absence, my health having gradually improved since the cessation of the late east winds"; and again, 11-4-24, "My health is precarious, and tho' the violence of my disorder has abated, I am still little better than convalescent, as every passing shower amply warns me". Towards the end of May he had another alarming attack, and had to send forward to Hoshangābād[7] for medical aid. Dr. Griffiths came out 40 m. to attend him, and continued to look after him after his arrl. there for the rains [403–4].

Whilst at Hoshangābād, he was cheered by the company of an old friend, Robert Low, of the pol. service[8]; "this gentleman and I had formerly been on the political service together at the siege of Callinger[9], and I had afterwards been in cantonment with him, and commanded the field-guns of the battalion to which he belonged. We were now thrown together in one of those odd modes which could never have been anticipated, and as he was a person of mild and amiable manners, and very much beloved amongst the wild Goands who were under his authority, it was evident that no possible means would be left untried of guarding against the dreaded want of water and provisions.

"And, accordingly, whilst in the Baitool district[10], which fortunately was the principal theatre of my operations, provisions seemed to rise up as if by enchantment. Whence they came no one knew but my friend Captain Low and his agents; for all around was a dreary wilderness, with a few miserable hamlets inhabited by Goands, who...were forced every third or fourth year to abandon their dwellings... because the powers of the worthless soil in the vicinity were all exhausted"[11] [245].

Everest was now called on to justify to the Directors his fitness for charge of the svy. [308], a challenge he eagerly accepted; "Though it would ill become me to enter into any encomium upon my own...acquirements, yet...there are few subjects in mathematics which I have not studied, and...my attention has for the last 6 years been unceasingly devoted to...both the theoretical and practical parts of my profession as a Geodesist. ... Had I been an incapable man...I should have trembled at the thought of succeeding to a man of Lt. Col. Lambton's high fame, ... and should at least have availed myself with avidity of the...privilege allowed to sick officers of...leave of absence but, instead of this, I have risen from the bed of sickness at a time when my life was despaired of by all my medical friends.

"I set out from Hyderabad in October last to pass through a...jungle of 340 miles, ... with hardly a hope that I should

[1] DDn. 172 (12–4), 27-2-23. [2] DDn. 171 (105) 26-3-23 & 197 (131), 27-6-23. [3] Geo. Everest (31). [4] DDn. 198 (109), 18-8-23. [5] Geo Everest (36). [6] DDn. 91 (359–61). [7] pl. 17, Husungabad. [8] (1791–1863); Ben. Inf.; Ens. 1810; Lt Col. 1842; AGG. Saugor & Narbada from 1823. [9] No corroboration of either being at siege. [10] Betul, pl. 17. [11] Geo. Everest (38–9).

live to cross the Godavery. In the severest state of most excruciating disorder I persisted, in spite of all remonstrances on the part of...Mr. Voysey, in sitting for 30 nights together at the zenith sector, and 20 at my transit instrument. Instead of availing myself of the leave of absence which the Supreme Government were pleased to grant me, ... I have ultimately succeeded in surmounting the very tract...which was once conceived to form an impenetrable barrier to our further progress, with a rapidity quite unexampled, without the loss of a single individual of my establishment from sickness or other causes, and with the fairest prospect of completing the whole section of 3 degrees of latitude in one season. ...

"If any doubt should still remain in the minds of the Hon'ble Court of Directors respecting my competency, ... there is one mode in which a full and satisfactory decision may be formed. ... The section of the Grand Arc on which I am engaged will...terminate in the plains of Seronge, at a distance...of 207 miles from...Takelkhera, of which 60 miles only remain to be traversed, all the rest having been...carried on...by a series of triangles as symmetrical and elegant as any geodetical operations in the World can produce. It is of essential importance that this section should be completed in January next and, unless I am overruled by circumstances beyond my controul, I am quite sure of accomplishing this desirable end by the latter end of the month [239, 241–6].

"When that is attained, if I am permitted to proceed to England...without relinquishing my situation, I shall be most happy to undergo a public examination respecting my professional qualifications before such learned men as...are qualified to form a fair and impartial decision"[1].

Blacker, as SG., had the fullest confidence in Everest's ability, though we have no record that the two had yet met, and there was no real doubt of Everest's confirmation; indeed, as Everest points put elsewhere [308, 446], there was no other possible candidate. ... Everest invited Blacker to inspect him at work, and was disappointed that he was unable to do so; "I purpose being at Seronj during November, December, and January, which three months will be occupied in...the most delicate parts of the operations. ... The whole of my establishment and material will be in the field at once, and if your presence could possible be spared at the Presidency, you would, I humbly think, derive much gratification by honouring my camp with a visit"[2] [293].

After rest at Hoshangābād with skilled med. attention, Everest pushed on his triangles and successfully completed the meast. of his base-line, and the neccessary astrl. obsns. [89, 190, 249–51]. But he found the work a great strain, and lived at such high tension that he was particularly liable to outbursts of temper.

We have already told of his trouble with Olliver during the meast. of the Sironj base-line [381, 492]. He had further trouble with Rossenrode, whose horses kept him awake in camp one night [499]. Not knowing who the owner might be, he wrote the following morning to Olliver;

"A horse, which I am told belongs to you, made so much noise last night as to keep me awake for several hours, and notwithstanding my Havildar-Major was twice sent to have the nuisance removed, yet it still continued with very little abatement until past midnight. I must desire that you will ...prevent such an annoyance again occurring, for it is not only in direct disobedience of my standing orders that neither men or cattle should make any sort of disturbance within my hearing, but it is absolutely impossible that I should continue to perform my duty in my present state of health if my natural rest is thus...broken"[3].

Many months later he raised the incident against Rossenrode, who had annoyed him by a unwise request, and had since been proved to have been the owner of the offending pony. "Ever since the commencement of December 1823, an order had prevailed in my camp that no noises were to be made by man or beast which might...disturb my rest. ... It had never been violated until my camp was at Soorental[4], when some neighing horses were fastened so near to my tent as to prevent my getting any sleep. This nuisance continued for three nights in succession and, notwithstanding all my endeavours, I was unable to discover who were the promoters of the riot. On the 4th day I had a proclamation made... that the sentries had orders to turn all neighing horses and other noisy beasts out of camp, and a naik and 4 sepoys were directed to go the rounds and see this proclamation carried into effect.

"It now appeared who the real offender was that had set himself up in opposition to all authority. ... You were that person; ... it was a horse of yours which created the nuisance, and...when the Naik went to execute the orders given him, your horse-keepers violently resisted him in the performance of his duty, and said that your neighing horses should not be removed without "cutting their throats". Disgraceful and insubordinate as this was in a civilised camp, yet it was trifling compared to your own conduct on the occasion. You were in the observatory at the time employed in registering the means of the angles, and you burst forth in a torrent of insolent railing towards me, which would have more befitted a lewd scold in the purlieus of Billingsgate or Wapping, than a person who had been accustomed to the decencies of life.

"I will not here recapitulate what you said, nor should I have been so particular in detailing the above circumstances, but for your alluding to some debt of gratitude which you seem to think I owe you for some imaginary service. I am not aware of any such debt, but I think it would be much more becoming in you to evince your gratitude to me for not handing up this disgraceful conduct of yours to the Supreme Government. ...

"The books which you despatched by dawk bangy arrived here last night but...owing to the careless manner in which they were packed, they have been soaked through and through, and are very nearly destroyed [419]. I cannot conceive how any person in his senses should think of despatching such valuable documents in the height of the rainy season in any other than a tin case. A mere wax-cloth covering can only furnish protection against slight showers, and is obviously altogether inefficient against heavy rains"[5].

Early in March Everest applied to take leave to Europe after completing his compns. He had now beenin India 19 years. His resolution was confirmed by a return of his illness at the end of the month; "After the last angles had been taken at Bhowrassa, an attack of my old complaint, more than usually violent, took place, so that even the motion of the palanqueen caused the most intense agony. I was conveyed to the house of...Major Feilding at Goonah[6] [447], where I remained some months, and then went to Calcutta...on my way to England"[7]. Leaving Guna on 25th May, he marched to Cawnpore, and took boat down the Ganges on 4th July, arrg. Calcutta 12th August. He was granted furl. on sc. under BGO. 14–10–25, sailing 11–11–25 [241, 246].

He asked to be placed on duty for the selection of suitable new insts., and also to take home copies of all his obsns. that he might there work out the results. The Directors refused to place him on duty, but welcomed his advice about the insts., and gave every facility in their selection [9, 246, 257–60].

They refused at first to keep his appt. open, saying that they were quite ready to appoint another officer to carry on the work, but no one suitable could be found. "When in 1825 I was about to...return to England; when in fact most men looked upon the close, not only of my connexion

[1] DDn. 171 (240–7), 26–7–24. [2] DDn. 172 (219), Sept. 1824. [3] ib. (331), 20–2–25. [4] 10 m. N. of Sironj, pl. 17. [5] ib. (447–54), 5–10–25. [6] 45 m. NW. of Sironj. [7] Geo. Everest (44).

with the Great Trigonometrical Survey, but of my earthly career, as...at hand, the Government of Bengal, in resolving to keep the situation open during my absence, ... were not actuated by private regard...to me, for I had no interest with my Lord Amherst, and had never acquired the art of paying my court to the great, or gaining their favour by other means than deserving it. It was the difficulty of finding a competent successor that induced the step, and if a suitable person could have been met with, he would have been put in...immediately [242, 308, 445, 458]"[1].

After much corr. and several extensions of leave, the Directors refused to allow his full Indian salary, though Everest urged that "it had been open to him, instead of coming to Europe, to go to the Cape, where under the regulations he would have been entitled to draw all his pay and allowances, and 5/6ths of his salary as Superintendent of the Trigonometrical Survey, counting the period of leave also for pension on full pay of rank, ... whereas...for the last 16 months, and for the first 6 months of 1827, his time has been so much occupied that he has given up all society, and has taken one expensive journey to Ireland, and frequent minor journeys on...the business of the Company". He was then awarded "the regimental allowances of...rank for the first 6 months of 1827, and the regimental allowances together with the pay of...rank from November 1828 up to the date when you shall cease to be employed"[2].

He was allowed his expences on Gt. Arc book, which contains vivid accounts of the country and his personal experiences, with revealing comments on Lambton and his assts., freely quoted here under ref. "Geo. Everest". He was further allowed "expense of 2 pounds a week, together with...contingent charges for writers & stationery...for adjusting & drawing up...the computations now completed. Expences may be incurred to prepare the materials of the 5th Section of the Meridional Arc left incomplete at Colonel Lambton's death [246]. ...

"Ref. the Astronomical Clock presented by you to the Government of Bengal, and 2 copies of Taylor's Logarithms left by you in India for the Trigonometrical Survey, the Court has resolved to present you with a chronometer in return for the clock, and two Tables of Logarithms, whichever work you prefer"[3].

Not only did Everest spend much of his leave travelling in England and Ireland to visit units of the Trig. Svy. and inst. makers, but he also visited scientific instns. on the continent. A letter of 29-5-28 was addressed to him at Rome[4].

He consulted Col. Colby[5] about new zenith sectors and apparatus for meast. of base-lines, and Col. Salmond [283 n.1] about the work of the Trig. Svy. in general. He wrote a memoir of 70 paras. comparing work in Ireland with that in India[6].

He was elected member of the Astr. Soc., after the presentation of his memoir on La Caille's work at the Cape [443], and a paper of his on spherical excess was read before the society on 9-4-24[7]. He was elected member of the Council 9-2-27, and read another paper, 13-3-29, on the subject of Pendulums; "In consequence of a desire expressed by the Court of Directors...that I should superintend a set of experiments with the pendulums lately constructed for their Presidencies of Bengal and Bombay, and avail myself of that opportunity to give the gentlemen cadets educated at Addiscombe some notion of the nature, objects, and use of these instruments", he spent some time investigating their errors and irregularities [254-5][8]. His demonstrations to the cadets were made at the Royal Obsy., Greenwich[9].

His work during these years in England, and the contact of his forceful personality, greatly impressed the Directors and, just as in the case of Blacker, this personal knowledge led them to appoint him SG. [301, 308]. Though he was still anxious to prolong his stay, the Directors insisted on his prompt return; "if he should fail to arrive in Bengal within 5 years from the date of quitting it, he will by law be out of the service"[10]. He rejoined at Calcutta more than a month within his time, and took over duty as SG. 8-10-30, to open a new era in the history both of the Surveyor General's Dept. and of the GTS. [264, 325-6, 432].

Everest's career in the GTS. can hardly be attributable to the education given at Marlow and the RMA., at the latter of which, writes Markham, he "passed a brilliant examination". He reached India, moreover, at the early age of 16, and could have had little encouragement to develop his learning during his earlier years of mil. service. He must, however, have displayed outstanding ability and a genius for overcoming practical difficulties to bring himself to the notice of the GG. His selection to be Lambton's asst. and understudy was indeed a fortunate one, and there were few of the Company's young officers who would have made so fruitful a use of so short an apprenticeship before taking over so exacting a charge. His only possible rival for the appt. was James Garling[11] [308, 342-3, 450].

He was prompt to note the disadvantages of much of the routine that Lambton had regarded as essential, and prompt also to snatch at devices and phenomena which promised escape from these handicaps. He was not afraid of backing his own views, and had indeed a genius for invention and mastery of essentials that worked more and more to the success of operations that called for exceptional methods [121, 127, 186, 196, 210, 215, 251-7].

The greatest years of his work began with his return in 1830. The years before had been years of apprenticeship from which he had drawn the utmost value [10, 93].

EWER, Walter, junr. BCS.
b. 1784. d. 5-1-63.

Writer 13-10-1800 ... Magte., Meerut, 27-10-25; ret. 24-1-39.

Son of Walter Ewer, friend of Wm. Hickey and Judge at Calcutta High Court, at one time Govr. of Ft. Marlborough or Benkulen[12], and Director EIC., 1792-5.

FRS., FRAS. FRGS.

DIB.

Wounded at capture of ship *Kent* by French.

"Well versed in music and astronomy"; 1822, using telescope, was first to read inscriptions on Qutb, near Delhi.

JASB. I, 1832 (550); II, 1833 (41); obsd. long. of Benares and other places [495]; ib. IX, 1840 (808-20), long. of Sylhet.

FAITHFUL(L), Richard Coventry. Ben. Inf.
b. 9-11-1787. d. Morādābād, 13-8-35.

Ens. 22-3-06 ... Lt Col. 23-2-35.

Son of Richard Coventry Faithful and Martha his wife.

m., Calcutta, 8-1-16, Miss Catharine Williams, who d. 5-6-80, aged 83.

As J. XIX, 1836, *As Int.* (138, 167); Hodson, II (159).

[1] Everest (116-7). [2] viz. Rs. 431 p.m.; Com. Corr.; 6-4-30; CD Misc. 69 (1092), 8-5-30. [3] ib. 68 (2054). [4] CD Misc. 67 (1446). [5] Thos. Fred. Colby (1784-1852); 2/Lt. RE. 1801; FRS. 1820; DGOS. 1821; *DNB.* [6] BM. Addl MS. 14380 (72-94). [7] *MAS.* II, 1826 (37). [8] ib. IV, 1830 (35). [9] CD Misc. 68 (166), 22-1-29. [10] ib. 69 (110), 13-5-30; Com Corr. 19-5-30. [11] Everest (116); Mackenzie to Riddell, 27-12-17; Riddell [497-9] to Mackenzie 26-2-18 [450]. [12] Hickey, IV (208-10, 241).

22-2-12, wounded at siege of Kālinjar, whilst attd. to Pioneers, of whom 41 were also wounded[1].

BGO. 9-2-16, to svy. Calcutta suburbs [12]; BMC. 12-8-17, from Maj. of Bde., Cuttack to be member of Telegraph Com. [270-1]; 1818, Dep. Postmaster, Cuttack.

FALLOWS, Rev. Fearon. Astronomer.
b. 4-7-1789. d. Capetown, 25-7-31 ; bur. in obsy. grounds.

HM. Astronomer at Cape of Good Hope, 26-10-20.

Son of a weaver, parish clerk to Rev. A. H. Hervey, vicar of Bridekirk.

ed. by his father and at John's Coll. Cambridge; 3rd. wrangler 1813, John Herschell being senr. wrangler.

m., 1-1-21, Mary Anne Hervey, dau. of father's patron.

FRS.; Gill (viii-ix); RAS. (mn), II (63).

Previous to appt. had no practical experience in astronomy; arrd. Cape, 12-8-21.

1821, assisted Everest in enquiries about work of La Caille [443]; 1822, consulted by Hodgson regarding corr. astr. long. obsns. [187]; 1823, helped Grant with obsns. for long. by lunar transits, and other obsns. at Cape [183, 455].

FERGUSON, Rowland Burton. Ben. Inf.
b. 5-7-1790. d. Chittagong, 12-12-25.

Ens. 16-7-07 ... Capt. 12-1-25.

Son of Wm. Ferguson, surg.

Hodson, II (174).

1812-4, survd. route of Rāmgarh Batt., Hazāribāgh to Surguja, etc.[2] [47]; 1817, survd. road from Gaya to Patna [27].

BGO. 21-10-17, appd. asst. to Everest on svy. of telegraph line to Chunār [270-2, 441-2]; svy. closed 16-10-18; June 1820-2, asst. to Playfair on construction of towers, salary Rs. 100 pm.; BGO. 3-5-22, appd. to svy. Surguja; completed 1823 [88, 201, 312]. 1825, Burmese War, Arakan.

FEILDING, William George Augustus. Ben. Cav.
b. 26-11-1784. d. 1868.

Corn. 17-4-01 ... Lt Col. 17-5-29; ret. 27-4-33; Hon. Col. 28-4-54.

Son of William Robert Feilding, and Mary Magdalene Hartley (or Huntley) his wife. L. F. Everest [441] calls him cousin to Earl of Denbigh, whose family name is spelt as here given. Sd. name "Feilding" on map of Gwalior described below.

Hodson, II (181), spells name Fielding.

1824-5, PA. in Gwalior State 1819 to Sept. 1830; took obsns. for lat. at Sironj [243]; befriended Gerard, May 1823, and Everest, May 1825, at Guna, his hdqrs. station [246, 445, 452][3].

MRIO. 84 (45-7), svy. of Sindiah's country, shewing theodolite bearings.

Nov-Dec. 1830, Resdt. at Kātmandu, Nepāl.

Godfather to Everest's eldest son, Lancelot Feilding [1853-1935], who describes friendship between him and his father[4]. Given copy of Great Arc book in 1830.

FISHER, Thomas. Ben. Inf.
b. 25-3-1798. d. Gauhāti, 24-7-47.

Ens. 13-3-18 ... Maj. 19-2-47.

Son of Thomas Fisher, of St. James', London, HM. Messenger[5].

m., Comilla, 1-11-23, Emily Maria, dau. of Wm. Terranneau of Sylhet, and sister of Robt. Terranneau [507].

Hodson, II (185); III (723).

First emp. in HM. Ordnance Dept.; 1817, appd. PS. to ambassador to Portugal, but preferred EIC. cadetship.

BGO. 17-12-19, appd. to svy. Sylhet boundary, but did not start work till after rains 1820 [49-50, 79; pl. 19]; Mackenzie writes to him from Palta [477 n.1], 29-3-20; "I am very desirous of...seeing you, and as I cannot go to town till next week, if you could with convenience to yourself come out for a day I should be happy to see you here. 3 hours of the tide in a bauleah will bring you here, & we have accomodation for you without any inconvenience. ... The Office is in Chouringhee, not far from the Military Auditor's"[6].

April 1821, held prisoner for about a week by Rāja of Cāchār [50, 411]; "Lieut. Fisher, Assistant in the Surveying Department, has been siezed and confined...whilst surveying our boundaries in the direction of Sylhet. He is confined at a place called...Kutchar, to the eastward of Sylhet. It is a very hilly country, and was conquered about two years ago from the aborigines by a force of about 600 men sent by the Burma Rajah. Fears are entertained of Lieut. Fisher's life, as much from the unhealthiness of the climate as from the cruelty of the Burmans"[7].

MRIO. Misc. 6-0-22; 4 sections of artistic panoramas along Cāchār frontier, 1821-2.

BTC. 1-8-22, appd. to rev. svy. of Sylhet under Commr. [7, 51, 144-5, 333, 369] and, 22-2-23, appd. DAQMG. for svy. and general duties [51, 337]. SG. writes, 18-10-23; "I have so good an opinion of him that I would have been desirous of employing him in the centre of India, had I not foreseen the probability of his being useful when there should be any impending eastern fracas"[8].

Dec. 1823, diverted to mil. duties as the Burmese threat to frontier increased; Govt. noted that as " he is employed just now both in the Judicial and Political Departments, and...also actually...employed on Commissariat and Quarter-Master General's duties, the Governor General in Council considers it expedient to leave him floating amongst the several departments until a more favourable opportunity may offer for fixing him in some particular one"[9].

BTC. 21-5-24 (31), assumed ch. of commt. with mil. dett. at Badarpur from 9-1-24[10]; 11-1-24, despatches from "Budderpore", Sylhet, show Fisher on General Staff, and in fdbk. of June 1824 Fisher notes that, "Accounts having been received of the Burmese army advancing again from Munnipoor into Cachar, and it appearing probable that the large force (20,000 men)...would move on Sylhet, the troops at Budderporr were withdrawn to this place, and instructions given me to intrench some building of masonry conveniently situated, with a view to a regular defence until the arrival of reinforcements.

"Employed from 5th to the 8th, inclusive, in laying down the outline, and in directing the construction of the works with 50 convicts. About 100 men employed in cutting and preparing trees for palisades, and several blacksmiths employed in making picks, shovels, nails, hammers, etc. June 9th. Received instructions...to reconnoitre closely and prepare a plan of the country eastward"[11].

[1] Cardew; Pogson. [2] Fdbks. MRIO. M 542; report, ib. M 575. [3] Geo.Everest (44). [4] LFE. (12). [5] Foster (111), refers to coloured proof engraving, by Thos. Fisher, of EIHo. of Roman pavement, London, 1805. Identity not established. [6] DDn. 156 (175). [7] *CG.* of 1st May; *As J.* 1822 (501). [8] DDn. 198 (124) [9] DDn. 205 (124) 29-1-24. [10] 15 m. W. of Silchar, capital Cāchār. [11] DDn. 212 (571).

12-2-25, had carried svy. to within 25 m. of Manipur [484].

BTC. 4-8-26, to resume rev. svy. Sylhet Dist. [51, 145-8, 216-7, 305]; Sept. 1828, survd. "along the rivers to Mymensingh. and back over the hills to Bansicoorah, settling the boundary with the Kossyahs"[1] [52]. Oct. 1828 expecting "double-altitude instrument of delicate construction", made for him by Dollond [181, 183]; MRIO. 34 (22), svy. of SE. Sylhet to borders of Tippera Dist. and Tripura State; many of Rennell's positions found "from ten to forty miles too much to the north". ib. 37 (28, 29), various route svys. between Sylhet and Sunamganj [434].

18-4-29, writes to SG.; "In consequence of the barbarous murder of Lieutenants Bedingfield and Burlton at Nongklao [64, 423, 431], and the breaking out of hostilities with the Cossyahs, the troops in this quarter have taken the field, and my services accepted as needful with them. Not having had time to make up my field books for the past month, I hope you will pass my certificate on the accompanying abstract as before [353-4]".

B Pol C. 18-6-30 & BTC. 29-6-30, placed under AGG. of NE. Frontier for pol. ch. of Cāchār; ib. 10-6-33, appd. Princl. Asst. to AGG. NE. Frontier, in ch. of Cāchār, "offg. Collr.", on consolidated allce. Rs. 1,000. BRC. 12-1-36 (27), ordered to regtl. duty, as services can no longer be spared for civil employment.

JASB. IX. 1840 (808-43); "Memoir of Sylhet, Kachar and the adjacent districts"; of much historical interest; p. 826 describes Verelst's expn. to Cāchār 1762-3 [I, 82].

JASB. I. 1832 (305-6), article on timber trade in Cāchār.

1845, Comdt. 2nd Assam Lt. Inf.

FITZGERALD, William Robert. Ben. Engrs.
b. Cawnpore, 14-12-1798. d. Calcutta, 1-12-44. MI. Circular Rd.

Ens. 1-9-18 ... Maj. 3-9-40.

Son of Martin Fitzgerald, Ben Cav., & Barbara Loftie his wife, heroine of breach-of-promise case in 1792 [II, 400].

ed. Addiscombe 1814-6.

m., Calcutta, 19-5-25, Sarah, dau. of Robt. Fulcher, and probably sister of Robt. Page Fulcher, Ben. Inf. [474].

Hodson, II (190-4).

1824-5, svy. of river embankments, Jessore Dist. [15]; *Ben. Sel., Canals* (5), Report on levels of Salt Lakes; svys. embodied in Prinsep's Atlas of Ganges [14, 16].

Ben. Regr. 4 (15, 20), 6 (36) & MRIO. 48 (18), 1829-30, svys. for new roads, Budge Budge to Paunchkoorah Ghāt and Kidderpore to Diamond Harbour, with asst. Josiah Rowe.

Ben. Regr. 38 (124), Sept. 1829, svy. of Gandak R. with embankments, Sāran & Tirhut dists.

1830 till death, engr. duties. Lower Provinces, including demolition of wrecks obstructing Hooghly navigation[2]; Civ. Architect, and member of Survey Com.

FORBES, William[3] Nairn. Ben. Engrs.
b. 3-4-1796. d. at sea 1-5-55, nr. Aden, on voyage to England.

Ens. 29-9-16 ... M Gen. 29-11-54.

Son of John Forbes, of Blackford, and Anne Margaret Gregory his wife.

m., Calcutta, 18-6-36, Sarah, dau. of Chas. Becket Greenlaw, coroner of Calcutta.

ed. King's Coll., Aberdeen, and Edinburgh Univ.

Hodson, II (202); III (778-9).

Attended svy. course with OS., his instructor Robt. Dawson writing later, "Forbes, poor fellow, has been extremely ill from the climate, but had struggled on, and got thro' a very extensive survey of part of the Delta of the Ganges"[4].

BGO. 8-11-16, appd. to svy. embankments along Ganges in Rajshāhi Dist., fdbk. 14-1-to 4-3-17, MRIO. M 280, sd., Sarda, 5-6-17 [15].

1819 to 1823, and from 1836 till death, Master of Mint, Calcutta; architect of new Mint, 1831, and of St. Paul's Cath[5].

FOSTER, Robert. Bo. Engrs.
b. 26-4-04. d. 4-6-42.

Ens. 19-12-20 ... Capt. 4-7-32.

Son of Rev. Robt. Foster and Elizabeth his wife.

ed. Blundell's Tiverton, and Addiscombe.

m. Susan Augusta, dau. of Wm. Downes Phillott.

Bo RC. 29-8-23, appd. to Deccan Svy; "Is acquainted with those branches of mathematics which are indispensably necessary for a surveyor who hopes to excel in his profession, and was also employed on a survey in England for some time. ... Having always had some duty to perform since he joined the Military College at Croydon to the present period, will bring with him that habit of application so necessary to this department"[6].

1823-4, on trgn. along Bijāpur-Gulbarga frontier, connecting with Garling's trgn. [129]; 1825, descriptive memoir, with svy., of Ghāts between Kusār and Hurun rivers; MRIO. 127 (9), map of Kolhāpur [126 n.3].

1836, Supg. Engr. roads & tanks, S. Konkan-Poona-Ahmadnagar.

Bo Geo Soc P. 1839 (18-25); Description of the Cape of Aden.

FRANKLIN, James. [II, 397-8]. Ben. Cav.
bapt. 6-5-1783. d. 31-8-34.

Corn. 26-3-06 ... Maj. 7-7-33.

Son of Willingham and Hannah Franklin, and bro. of R. Adm. Sir John Franklin (1786-1847), RN., FRS., the arctic explorer.

m., Cawnpore, 7-4-18, Margaret Maria Clements, dau. of Gen. Sir Thos. Brown [II, 461]; she m., 2nd., London, 10-2-36, James Evans.

FRS.; *EIMC.* III (97); Hodson, II (214).

1813-5, on svy. of Bundelkhand [II, 51-2]; March 1815, to regtl. duty, Nepāl War [81]; Map of SW. Frontier, 1815, MRIO. 96 (13).

Pindāri War, BSC. 25-11-15, appd. "secretary to Col. D'Auvergne,[7] and to the charge of the Guide and Intelligence Department with the field force under that officers's command", 14-11-15 to 8-2-16.

BGO. 1-9-17, DAQMG. 1st. cl. [27, 335].

Marātha War, 1817-8, with Centre Div.; mentioned in despatches of Gen. Brown at capture of Jawad, 30-1-18.[8] Reports to SG., 18-6-19; "I was permitted to resume my survey duties in October 1815, but had scarcely begun before I was again called away to join the Troops under Colonel D'Auvergne intended to act against Saugor. I remained on this service until March 1816, when I again resumed my labours, and continued them without intermission for seven months in that year and four in the next, until the 30th April 1817, at which period I was forced into cantonments by sickness.

[1] DLR. M 70. [2] Sandes, II (176). [3] not Walter, as wrongly shewn p. 15. [4] Arden-Close, 12-10-1946. [5] Sandes, II (93-4). [6] from Jopp, 14-10-23, Bo MC. 98/1823 (308). [7] Philip D'Auvergne (1762-1818); Ben. Inf.; Ens. 1778; Col. 1813. [8] *Govt. Gaz.*, 26-2-18.

"I remained sick at Keitah[1] until September 1817, when I was ordered to Cawnpore, and was afterwards employed with the Centre Division of the Grand Army, and on my being relieved from that duty, I obtained permission to remain at Cawnpore until the end of October 1818. I then marched to Keitah and, having received instruments from you in November, I proceeded to Phullehra and resumed my labours in the beginning of January 1819"[2] [3, 81–2, 200–1, 394].

DDn. 154 (21), 12-9-16, Mackenzie considers him for post of ASG. ; "Capt. Franklin is so well spoken of by everyone that I can have no prepossession but what is in his favour". Later complains of irregularity of Franklin's writing to QMG. whilst employed under SG. [336–7, 348].

1820-1, on examination of maps in Govt. offices at Calcutta, and revision of map of Bundelkhand [290–1][3].

EIMC. III (103) ; "In 1820, his health becoming delicate from constant service, he proceeded to Calcutta, where he was employed...collecting and arranging geographical and other documents relating to the late campaign, and then proceeded to Singapore on account of his health.

"Whilst at Singapore, finding no survey in existence, he made a survey of that island, and prepared a series of points to serve as a basis for a large harbour chart. He returned to Bengal in 1822 and was appointed to conduct a survey of about 60,000 sq. miles but, finding his health not thoroughly re-established, he proceeded to England on furlough".

1823-6, furl.—21-5-25, read Memoir on Bundelkhand before R As Soc.[4]—Feb. 1827, map of Bundelkhand, etc., engraved and pub. by Horsburgh.

1827-8, survd. iron mines, Saugor and Bundelkhand ; applied unsuccessfully to succeed Voysey as geologist to GTS.[5] [301].

Furl. on mc. 1830.

JASB. I, 1832 (261), sends to ASB. "collection of birds made during tour up the Ganges, ... and in the Vindhyan Range between Benares and Mandela on the Nerbuda".

ib. II, 1833 (475-81), exbts. his geol. map of Bundelkhand.

FRASER, George John. Ben. Cav.
b. 14-5-1800. d. Aurangābād, 27-8-42 ; MI.

Corn. 13-7-22 ... Capt. 12-11-38.

Son of Edward Satchwell Fraser, of Reelig, co. Inverness, and Jane, dau. of Wm. Fraser of Balnain, his wife ; bro., of J. B. Fraser (1783-1856) [II, 398], and Wm. Fraser (1784-1835), BCS., of Rev. Bd. Delhi. [151].

m., Delhi, 12-9-32, Wilhelmina, dau. of John Moore, of Liverpool.

Hodson, II (217) ; Crofton, II (113).

BTC. 9-11-26 (60), appd. Asst. Survr., Sahāranpur Rev. Svy. ; joined 1-1-27, on completion "3 years actual regimental duty" ; continued on rev. svy. till 1835 ; Asst. to Resdt. Nāgpur, 1836 till death [157, 165, 334].

GALE, John. Land Survr. (?), England.

Compiled tables from which a traverse could be laid down from rectangular co-ordinates instead of from bearings and distances.

Formulated a simple method of calculating the contents of an area from the rectangular co-ordinates of the successive traverse stations enclosing it.

Both these valuable aids to surveying were pub. in *Geometrical & Graphical Essays* by Geo. Adams, junr., London, 1st edn. 1791, the table forming an appx. In the 4th edn., 1813, the table was issued as separate vol., price 2s 6d.[6]

Gale's system was first adopted by Oliver on the Delhi rev. svy. in 1822, and at once adopted generally under the orders of Hodgson as RSG. [148, 160]. To this very day it forms the basis of all traverse survey in India[7]. Surveyors often referred to it as Gale's Universal Theorem [148 n.1].

The projection of a traverse by rectangular co-ordinates is described by John Love in his *Geodæsia, or the Art of Surveying*, 2nd edn. pub. London, 1715, and a Table for the purpose is given. All other early writers confine themselves to the protraction from bearing and distance[8].

The deduction of areas by sum of products is described on pp. 488 of Chas. Hutton's *Treatise on Mensuration*, Newcastle-on-Tyne, 1770, where Hutton refers to this as Thos. Burgh's "method to determine the areas of right line figures".

Doubtless Gale was familiar with the works of Love, Burgh, and Hutton.

Nothing certain is known of John Gale himself beyond infn. given by Adams in his *Geometrical... Essays*, but it is a fair presumption that he was the author of *Cabinet of Knowledge*, by J. Gale, 1st edn. 1796 ; 2nd. 1797 ; 3rd. 1800, 4th 1808.

The following are extracts from Adams' *Essays* :

pp. iv-v refer to "valuable communications of Mr. Gale. ... Mr. Gale's improvements...consist, first, in a new method of plotting...from the northings and southings, eastings and westings, taken out of the table which forms the appendix to this work. ...

"The next improvement consists in a new method of determining the *area*, with superior accuracy, from the northings...and westings, without any regard to the plot or draught, by an easy computation".

In a footnote Gale is described as "a gentleman well known for his ingenious publications on finance"[9].

p. xiv, describes the Appx. as "A Table of the Northings... Westings, to every degree and fifteenth minute of the Quadrant, radius from 1 to 100, with all the intermediate numbers computed to three places of decimals".

pp. 299-310 include description of the circumferentor, "with Mr. Gale's method of using it", an elementary account of normal theodolite boundary survey.

pp. 329-33 describe "Mr. Gale's method" of plotting from his Table, with the normal traverse set-up.

p. 339. "These computations are of much further use in determining the area or quantity of land in the survey, which cannot be ascertained with equal accuracy in any other way".

The *Cabinet of Knowledge* contains "Miscellaneous Recreations, ... moral and philosophical essays, propositions natural and metaphysical, experiments, ... including card deceptions. ... (Being the essence taken from the Lady's, Gentlemen's, ... Diaries)". London. Printed by W. Kemmish [1796]. 12mo. pp. 350. pls. 61.

The contents include—Moral & Religious Talks—Nature of Eclipses—Calendar—Card Tricks—Problems of Numbers—Camera Obscura—to Measure the Depth of the Sea—Queries & Paradoxes—Optical Definitions—Light & Heat.

Similar calendars, almanacs, and diaries were popular at that period, and such distinguished mathns. as Hutton and Reuben Burrow made money in this way [I, 316].

[1] 40 m, w. of Bānda [II, 50 n.1]. [2] DDn. 69 (11). [3] DDn. 166, M 331 ; maps of sw. Frontier, MRIO. 96 (13-8). [4] *R As Soc. Trans.* I, 1827 (259). [5] BTC. 25-5-and 1-6-26. [6] 2nd edn. ed. by Wm. Jones, 1797 ; 3rd, 1800. [7] Thuillier & Smyth (273-84) ; *Ency Brit.* 9th edn. 1887, *Survey*, by Gen. J. T. Walker. [8] even as late as *Ency Brit.* 7th edn. 1842. [9] no such pubns. traced.

Prolonged research in libraries and registers, London, Oxford, and Bristol, have failed to fix the identity of Adams' collaborator, though the name John Gale is frequent between 1780 and 1820, especially in London and the West.

A John Gale served in the Customs Dept. in London, being appd. Western Clerk[1] and Examnr. of Stationery @ £ 130 pa., 20-6-1787, and promoted Sec. @ £ 400 pa. from 23-2-1788. He resd. 29-7-91. His letters and autographs are those of an educated man of mature age[2].

A John Gale "Esq." d. 19-10-1814 in Charles St., Covent Gdn.; *Gents Mag.* 84 (502).

A John Gale, of Pall Mall Place, St. James', Westminster, left will, proved 1823, with mention of a wife Harriett, and bro. Wm., of Customs Ho. London.

Our man may have been a scholar rather than surveyor, but was obviously of practical bent, and must have had some education in survg. and maths. He may possibly have assisted Adams in producing other prof. pubns.

GARDEN, William [II, 399]. Ben. Inf. bapt. 8-3-1790. d. 29-7-52.

Ens. 29-11-13 ... Bt. Col. 2-8-50.

Son of Alexander Garden and Grizel McCombie his wife.

ed. King's Coll. Aberdeen.

CB.; ADC.

Hodson, II (246); III (782).

BGO. 1-1-17, appd. DAQMG., 3rd. cl., whilst with 1st. Div. Grand Army; ib., 31-8-17, to svy. frontier between Nepāl and Champāran [19]; 1818-9, survd. routes in Rohilkhand [27] with occasional latitudes and 2-inch plan of Bareilly Cants., MRIO. 32 (1-61); "will form very good geographical material"[3]; BGO. 16-10-19, DAQMG. 1st. cl. [335].

1823, as AQMG., Malwa Force, survd. routes to Saugor and Hoshangābād; DDn. 193 (87), 11-11-24, Resdt. Indore writes; "Captain Garden, ... an officer of superior intelligence, being the last dry season engaged in a survey of the Vindhya range, ... I [requested] him to make a particular inspection of the space...between Jaun and Simrola. ... On the ground of Captain Garden's report, ... the Pioneers...at Mow should be employed on the improvement of the Simrol Ghaut[4], and the road onwards to Asseergurh" [87].

Later had distinguished career in QMG.'s dept [337]. 1839-40, Afghān War; MRIO. III (4-7), 1839, svy. of route Kandahār via Kābul to Attock.

GARLING, James [II, 399]. Mad. Inf. b. 16-5-1784. d. 4-6-20, of cholera at Hyderābād.

Lieut. 21-9-04 ... Bt. Capt. 1-1-18.

Son of John Frederick and Caroline Garling, of London.

April 1805, MMI., cl. I [II, 320]; asst. instr. from April 1806 to Oct. 1811 [105].

1810-3, in ch. Goa svy. [II, 156-8; III, 94, 196]; 1813-5, in ch. of Sonda svy. [II, 158-9], returning to Madras, Sept. 1815.

MGO. 10-5-16, appd. to ch. svy. of Nizām's Dominions [94, 97, 114-7, 119, 125, 207-8, 281, 339, 401, 417, 474].

Recognized by Lambton as survr. and trgtr. of high qualifications [II, 246; III, 121, 129-30, 207, 237, 257]. Everest's only rival for nomination as Lambton's asst. on GTS. [342-3, 446], Riddell writing to Mackenzie, 26-2-18; "I have no doubt that Colonel Lambton is endeavouring to get his department increased that Garling may have an opportunity of joining it. Should this be the case, it will illustrate what you have all along thought of the latter's intention"[5] [476].

Protested without success against appt. of Riddell as ASG. at Madras, on grounds of seniority, for some time subscribing his letters as Asst. SG. [316-8]. Was obviously making himself difficult, and Mackenzie writes to Riddell; "What orders have you been sending to Garling that he only finds fault with your designation in office? I wished much to have conciliated that gentleman, but find it difficult or rather impossible. ...

"I am surprized at his being at Darwar. I consider it entirely out of his province. I must soon turn my attention to Mr. Garling's surveys, as I cannot see...how he is employed. I think he, at all events, might let your case alone"[6].

Reference was made to the Supreme Govt., who supported Mackenzie's view "that the appointment of Lieut. Riddell to the provisional charge of the survey department was not calculated to throw the slightest degree of discredit on Lieut. Garling's character or professional pretensions, as being consistent indeed with the usage of other branches of the military service with regard to staff appointments"[7].

Riddell also wrote that he had "heard privately that Garling's objection was treated as a trifle, and as contrary to every precedent in this Presidency"[8] [477, 497].

Garling did not accept the decision with kindness, and Mackenzie writes to Mountford a few months later; "Mr. Garling...may with equal reason complain of you. ... As my sentiments have been so little acceptable, ... I do not wish to trouble him further than when my strict duty requires correspondence"[9]. Altogether there was a considerable lack of good feeling between Garling and the SG., which was not remedied when Garling pushed his svy. beyond the w. frontiers of the Nizam's territories without formal sanction, and appeared to be suiting his programme to the wishes of the Resdt., Henry Russell, rather than keeping to the SG.'s rigid instns. [4-5, 115-7, 304 n.2].

Mackenzie thanks Mountford for communicating "Captain Garling's intention of coming to Calcutta on the subject of his grievances. ... Some time ago Mr. Garling mentioned something about coming to Calcutta. ... I took no notice because I considered it neither serious nor necessary. ... Several of Mr. Garling's letters to me have been unanswered for some time, as it is impossible for me to reply to all private letters"[10].

In spite, however, of this lack of mutual sympathy, Mackenzie had a high opinion of Garling's prof. qualifications, and was deeply grieved at the news of his sudden death [117, 341, 459]. His brother officers were particularly distressed, and Conner writes;

"The account of poor Garling's death has filled me with the deepest affliction—so accustomed to associate him with all my most agreeable remembrances—so intimately united by ties of indissoluble friendship—so early known—so deeply regarded—I feel his loss as the severest calamity, for we rarely appreciate the just value...till tis without our reach. Always attached to his many amiable virtues, and respecting the rectitude of his principles, I suffer the misery of feeling his full worth at the moment I have to deplore his death; and memory, as if to aggravate those sentiments, retraces all the scenes of our long intercourse, whose harmony was never for a moment ruffled [433]. ...

"My regret for the loss of this excellent fellow has been feebly expressed. ... We both [Ward & Conner] agree with you that he was as amiable in private life as zealous and capable as a public servant. As such the department has severely suffered. ...

"I am very glad you have taken means to secure the books and instruments. He had some valuable ones which will be almost useless to anyone...not in the department—the Camera Lucida—...tent—...

[1] dealing with Customs matters of 42 ports sw. from Rochester to Wales. [2] BM Addl MS. 38225 (ff. 46, 110, 145, of 1790) and PRO/Customs/18/433-4, 459. [3] Everest, 17-6-31, DDn. 265 (208). [4] Simrol Ghāt, 20 m. S. of Indore [*Asseergur* pl. 24]. [5] DDn. 151 (148). [6] DDn. 156 (301, 304); 7-10 & 23-11-17. [7] DDn. 133 (97-9), 15-5-18; MMC. 16-6-18. [8] DDn. 151 (211), 1-7-18. [9] DDn. 149 (9), 2-11-18. [10] ib. (51), 23-3-19.

"I request the Encyclopædia may not be put up for sale—poor fellow—it was our joint property, a sort of family concern, that was more valuable as belonging to both, and one that I have now a melancholy interest in. In fact, ... a feeling entirely independent of the property itself makes me most solicitous to have the books"[1].

Poor Conner! He was to follow Garling in less than twelve months.

GARSTIN, Edward [II, 399–400]. Ben. Engrs. b. Chunār, 6–2–1794. d. 13–7–71; Bangalore.

Ens. 6–5–15 ... Gen. 1–3–67.

Son of John Garstin, Ben. Engrs., SG. Bengal 1808–13, and Mary his wife [II, 400].

m., Calcutta, 26–7–36, Mary Anne, dau. of Adam Duffin.

Hodson, II (252–3).

1814–5, Nepāl War; asst. survr. under Hodgson on Nepāl frontier [II, 41–2].

BGO. 31–9–15, with Hodgson to svy. of Garhwāl & Sirmūr [29–31, 459], being employed near Sabāthu. Resd. Nov. 1816, as allces. did not meet the heavy expenses of work in the hills [32, 346]; ib. 6–6–17, "to carry on the Public Works at Ludhiāna".

ib., 1–1–20, "to survey the Juboonah Creek for...ascertaining the feasibility of opening through it a channel of communication between the Hooghly and the Issamutty", commencing from 17–12–19 [15, 212]. 1834, as officer of PWD., survd. various roads in lower Bengal[2].

Had distinguished career as engr.

GERARD, Alexander [II, 402]. Ben. Inf. b. 17–2–1792. d. 18–12–39.

Ens. 9–9–08 ... Capt. 13–5–25; ret. 15–2–36.

Son of Gilbert Gerard, DD. of King's Coll., Aberdeen, and Helen his wife, dau. of John Duncan, Provost of Aberdeen; bro. of Patrick (1794–1848), Ben. Inf. (*DNB.; DIB.;* Hodson), and of James Gilbert (1795–1835), Ben. Med. (*DNB.; DIB.*) [40–1].

DNB.; DIB.; Hodson, II (259–60).

1814–5, on rev. svy., Sahāranpur, under Bd. of Comnrs. UP. [II, 180; III, 35, 37, 134, 149–50].

"These provinces", writes Anne Deane in 1808, "having been newly conquered, ... had as yet paid no revenue to Government, who...appointed two Commissioners to survey them, and form an estimate of what they were capable of furnishing. ... On the 1st day of December 1808, attended by a regiment of seapoys and a numerous retinue, we travelled in the suite of the Commissioners towards Delhi. ... Our line of march, including cattle, baggage-waggons, and followers, extended more than a mile". After tour in Rohilkhand, returned to hdqrs. at Fatehgarh[3] [151].

6–1–15, withdrawn for regtl. duty, Nepāl War; Dec. 1815 to Feb. 1819, again on rev. svy., Sahāranpur, Morādābād, and Dehra Dūn [22–3, 157, 178, 201–2, 204, 218]. 1819, joined Sirmoor Batt. at Dehra Dūn (197 n.2, 452 n.4).

Obsd. from Bhadrāj hill, cutting initials on survrs'. stone below Persian name ماه بیگم or Lady of the Moon [178; pl. 5, reverse]. Maps drawn by his asst. Blandford [297, 347, 360, 425; pl. 3].

Both in 1817 and 1818 spent two or three months in the hills, making journeys from Sabāthu, through Simla, to Kotgarh where his bro. Patrick was stationed during rains, and up the Sutlej valley which was then practically unknown [30, 40–5].

1817, left Sabāthu 27th. Aug., reached Rarang, 10 m. NE. of Chini, 20th Sept., and was back at Sabāthu 14th Oct., having made rough svy. with astr. obsns. [40].

1818, left Sabāthu with his bro. James, 21st Sept., reached Shipki 12th Oct., returned to Sabāthu 22nd Nov., and was back at work in the Dūn by 26th. An account of this 2nd journey appears in *JASB*[4].

17th Oct. describes march over Nako Pass; "The people with the perambulator and theodolite missed the way and did not arrive till midnight, and their hands and feet were almost frozen". They climbed to top of peak, 19,411 ft. above the sea. "It was 4 p.m. when we gained the summit, so we had no time to make half the observations we wished. ... Whilst I was setting up the large theodolite my brother tried three excellent barometers which we had the satisfaction to see stand exactly at the same point". They got back to Sabāthu on 24th Nov.

Sent SG. a note on weather conditions; "I have not had a great deal of experience in the mountain regions, but shall give the results of my own observations, and in a short time hope...to furnish you with a more correct information regarding the weather from my brother, who has resided above three years in the hills, a great part of which time he has kept a meteorological journal.

"October, November, are the most favourable months, the atmosphere being then more clear than at any time. December, January, are rather worse than in the low lands adjoining the hills, there being much snow. In February, March, it is sometimes practicable to carry on field operations, but more frequently not, especially in mountains above 7,000 feet high, when the roads are commonly blocked with snow.

"April, May, are capital months, but the atmosphere is not so clear as in October, November. The beginning of June is sometimes pretty good, but there is always a dense haze. The end of June, July, August, September, are the worst months, and although the roads are not, as in the plains, subject to inundations, yet it is scarcely possible to get an observation of the sun or stars above once in 10 or 12 days; the big hills are involved in clouds. There is sometimes, however, a clear fortnight in August"[5].

1821, made 3rd journey. Leaving Sabāthu with James early in June, he travelled alone after 23rd, and visiting the Baspa valley got well beyond Shipki, returning to Kotgarh 29th Sept[6]. Though Chinese guards prevented his working E. towards Gangotri or Lake Mānasarowar [pls. 5, 6], he added considerably to his svys. The memoir of his *Map of Koonawar*, was sd. 26–7–26 [41].

"In the *Transactions of the Royal Asiatic Society*, vol. I, part II, is a paper on the Valley of the Setlej River in the Himalaya Mountains, from the Journal of Capt. A. Gerard, with remarks by H. T. Colebrooke, Esq., which contains so much curious and interesting matter"[7].

In 1822 Alex. and James joined Lloyd and Robt. Close [II, 417 n.4] at Kotgarh for a journey to the Barendo Pass, travelling by the upper Jumna valleys [II, 417; III, 42]. They left Kotgarh 5–6–22, reaching Barendo on 12th. By obsns. of boiling water, Gerard deduced height of the pass to be 15,095 feet.

With Lloyd's *Narrative*[8] was pub. Alexander's *Account of an Attempt* [1821] *to penetrate by Bakhur to Garoo and the Lake Manasarowara* and also a letter from James "detailing a visit to the Shatool and Boorendo passes for the purpose of determining the line of Perpetual Snow on the southern face of the Himalaya". The two vols., with Gerard's maps were pub. 1840, ed. by Geo. Lloyd,[9] who had accd. the 1822 expn. as a child of 7. The second vol. gives Alex's. narrative in which he discussed the heights of peaks obsd. by his bros. Patrick and James as well as by himself, and compares them with those by Herbert pub. in *As R.*, XIV [204].

A further account of all Gerard's Himālayan journeys, with a map, was pub. in 1841 by Geo.

[1] to Mountford; DDn. 149 (123 a), 28–6–20. [2] *Ben Regr.*, 6 (38). [3] Anne Deane (139). [4] *JASB.* XI, 1842 (363–91). [5] DDn. 212 (3), 25–11–18. [6] IO Maps (27); *Edinburgh*, I, 1824 (41); Lloyd, II. [7] *As J.* 1826 (333, 427). [8] Lloyd, I. [9] kd. by shot-gun accident, Thebes, Egypt, 10–10–43, *JRGS.*, 1844 (xlviii).

Lloyd under the title *An Account of Koonawur in the Himalaya*"[1].

Describing a tour to the upper Sutlej in 1843, J. D. Cunningham regrets "that the Gerard's did not employ the same accuracy in general description which they brought to bear with so much success in ascertaining positions and in measuring the heights of mountains".

His bro. Alexander comments, 1847, after a visit to Ladakh via Kulu, on "the strange belief of the Gerard's that the snowy peaks to the north-eastward of Spiti and Lahul exceeded in height all that they had seen of the Himalayas. The Baron Humboldt...calls it an unfounded surmise, in which opinion I cordially agree, and I believe that I am fully borne out by the observations of Moorcroft and Trebeck when crossing the Kandu La"[2] [43].

In 1822, the SG. obtained his appt. for a svy. into Mālwa and Rājputāna[3] [3, 89, 361, 371].

"Lieut. Gerard, an experienced and very able surveyor who was formerly employed under the Board of Commissioners in Rohilcund, but who for some years past had been disabled by ill-health from exerting his talents in the plains, having now by a long residence in the Hills re-established his health, he is ready to undertake the survey. ...

"He is a surveyor of more than common talent, an expert practical astronomer, and conversant in the use of chronometers and also barometers, ... and has...a good collection of valuable instruments. "He is, besides, a person of a respectable character, and his conduct is calculated to conciliate, and not offend, the people of the countries in which he must act. ...

"If Government...order, ... I will direct Lieut. Gerard, who is at present doing duty with the Sirmoor Battalion[4], to proceed to Agra and commence the survey at the close of the rains, and...in the course of one season he will...complete the desired outline, and...assign to each of the principal places in it its true position in latitude and longitude, as well as to shew its height above the sea; and, as I will direct him to take barometrical observations between Saharanpoor and Agra, we shall be able to complete the sections of level from Cape Comorin to the 32nd degree of latitude in Tartary"[5].

Leaving Sabāthu 8–10–22, Gerard halted nr. Tāj at Agra 21–11–22 to 27–1–23, taking astr. obsns., and then ran his svy. through Gwalior and Sironj to Bhopāl, staying with George Feilding at Guna 3rd to 18th May [447]. Returned to Gwalior 2nd June; remained there, seriously ill, till 13th Sept. when he moved to Agra. At end of Dec. he set out on svy. w. to Kotah and Nimach. He again fell sick, but writes to SG. from Nimach, 24–4–24, sending results of astr. obsns.; "I consider the observations of Antares very valuable, since this phenomenon was visible in Europe, & an occulation of so bright a star does not generally happen oftener than once in 5 or 6 years [180].

"I am now...on political duty under...Major General Sir D. Ochterlony [II, 472; III, 89], & I am to act for...[the] Agent in Bangur, who will be absent from this station for some months"[6]; kept on to be APO. at Nasirābād nr. Ajmer.

Blacker considered this svy. "more important, and more scientific, than any which have fallen under my inspection"[7]. He tried more than once to get Gerard back, but owing to bad health and pol. duties it was not till Sept. 1826 that he was available [25, 90, 175, 365–6, 371]. Once again his work was cut short by fever which had troubled him "every year for these last six years".

Oct. 1826 left Calcutta by boat for Fatehgarh, "having ...a very valuable set of instruments, partly his own property, and partly that of the Government, and two European boys...from the Revenue Survey Department[8]. ... He was instructed...to make the best use of the time he must pass in boats by...assiduous attention to the barometer, to determine the differences of level of the river as he proceeded, and generally to take as many astronomical observations...as he could"[9]. From Fatehgarh he travelled by palanquin *dāk* to Agra and back to get a good value by chronometer for the long. of Agra [180]. Returning to Agra he made another trip to Kāsganj, about 70 m. to NW., but was driven back by further attacks of fever.

He was then held up several months at Agra till the SG., impatient at receiving neither fdbks. nor mc., obtained his discharge. Gerard was genuinely ill, and it is doubtful whether, even had Hodgson shown more forbearance, he would have been able to carry on further svy. in the plains. He writes, 17–8–27;

"I have as yet not been able to commence my march to the westward, from rain and bad weather. Severe ill-health has rendered me unable to take any observations for some time past, and if I do not get better of an extreme oppression at the chest soon, I shall be obliged to resign the Survey, as it pains me very much to stoop to write; and indeed I have been under the necessity of leaving off writing almost wholly lately. ...

"If I am not able to conduct the survey after the end of the rainy season, I shall resign and apply for leave of absence, as I have more than once been very strongly recommended either to go to sea or the hills. I did not attend to the surgeon's advice, and after staying so long in the plains... *I could not now get a medical certificate if I wished for one*"[10].

He suggested that some of the SG.'s letters had gone astray; "Most of my letters have lately been travelling over Rajpootana & Malwa. Two followed my brother [James] to Lahour, whither he was sent by Lord Amherst with the mission to attend upon Runjeet Singh, who was very ill. It is no unusual thing for my brothers to receive my letters, and me to get theirs, especially Patrick's, he and myself being...Captain, there being no distinction made in the Persian direction"[11].

He writes later from Fatehpur, 28–11–27; "Yesterday evening I had an interview with His Excellency the Commander-in-Chief, to whom I stated that the exposure I endured in the hot weather, when going by dawk with the chronometers to ascertain differences of longitude, was the principal cause that brought on a severe fever, which prevented me from sending regular reports, which was the reason I was removed from the survey of Malwa [90, 358]. ...

"His Lordship replied that he remembered my being removed from the survey because I was unfit to do my duty from illness, but it had not made the least unfavourable impression upon Government respecting me. He desired me to write you—say so—[and] mention that I had seen him. In his opinion, if my health admitted, there would be no difficulty in getting me re-appointed"[12]. We have no record of his being again employed on svy. or Himālayan travel.

James, his doctor bro., accd. Burnes into Central Asia in 1833 as far as Bukhāra, an effort which shattered his health. He was held up by illness at Meshed and Herāt, but continued to take obsns. and notes as far as Peshāwar. He "died worn out at Sabathu", 31–3–35.

[1] *Koonawur.* [2] *JASB.* XIII, 1844 (240); XVII, 1845 (230). [3] from Ch. Sec. to SG., 1–11–22, DDn. 195 (201); Gerard "lately" appd. asst. to Resdt. in Mālwa. [4] later the 2nd Goorkha Rifles. [5] DDn. 93 (32) & 198 (93), 18–6–22. [6] MRIO. M 312 (118). [7] DDn. 220 (35), 12–?–24. [8] Edward & Michael Shiells [365]. [9] DDn. 201 (332), 17–5–27. [10] DDn. 220 (286). [11] DDn. 212 (313–4), Sept. 1827. [12] ib. (329–30), 28–11–27.

"Alexander got leave of absence on purpose to prepare a map of James' route from his notes, for he had observed the bearings, estimated the distances, and noted all the villages, all the way from Herat to the Indus", and, writes Alex., Aberdeen, 18-10-39, "It was a splendid map. It measured 10 feet long by 3 feet broad, on the scale of 5 miles to an inch[1]. At my brother's dying request I presented it to Sir Charles Metcalfe, then Governor General, from whom I received a thousand thanks. The map is now with the Army of the Indus, and I was gratified to hear that, as far as they had gone, they had found the positions of the places, and accounts of the roads, wonderfully correct considering the distances were estimated by time, and the bearings taken with a small pocket compass"[2].

Alexander ret. 15-2-36 and, writes Lloyd—"from the fatigues he had for many years undergone, together with a fever which since his return to England has periodically attacked him—his frame and constitution were shattered". He d. at Aberdeen, "his native town, ... after 3 days illness"[3].

JASB. XI, 1842 (479-551), Vocabulary of Kunāwar languages.

GERARD, Patrick. Ben. Inf.
b. 11-6-1794. d. Simla, 4-10-48; MI., cart rd. cem.

Ens. 19-8-12 ... Capt. 11-4-28; inv. 6-8-32. with permission to reside in the Hills.

bro. of Alexander and James Gerard [*sup*]. *DNB.*; *DIB.*

1817-32, served practically continuously with 1st Nassiri Batt. [30 n.7, 40 n.5] at Sabāthu and Kotgarh. A great gardener.

1819, with James Herbert on journey up Sutlej valley [38, 42, 204-5, 457].

Kept regular meteorl. and barometer records; abstract for 1819-20, with list of heights fixed by boiling point of water, *JASB.* II, Dec. 1833 (615-22)[4] [273]. "By the mean of a whole year's barometrical observations Soobathoo was found to be 4,205 feet above the level of the sea" [204].

In "statement of the weather at Kotgarh and Soobathoo", 1819-21, Patrick adds an interesting note about Simla;

"During the years 1819-20 and 21, Simla was no place of resort for invalids and visitors, except for a few officers belonging to the 1st Nusseeree Batt. stationed at Soobathoo, and thither they proceeded for the hottest months, May and June, till the rains had fairly set in.

"In 1819 a double-poled tent was pitched by Lieutenant... R. Ross[5] on the N.W. extremity of the ridge. ... In 1822 the first permanent cottage of the usual materials—stone and timber, roofed with pine-wood shingles—was erected...by Captain...C. P. Kennedy, the successor of Lieut. R. Ross as Assistant Political Agent for the Protected Hill States"[6].

GIBBINGS, John. Mad. Inf.
b. 24-7-1793. d. 9-1-18, of wounds received at Mehidpur [83 n.4], 21-12-17.

Ens. 4-8-10 ... Lieut. 11-11-14.

Twin son, with Robert [*inf*], of Rev. Richard Gibbings, of Gibbings Grove, co. Cork, and Catharine his 2nd. wife.

July 1815, MMI., cl. IX [II, 321]; 1817, AQMG. 2nd cl., Svy. Branch.

Kaye, II (214); Malcolm's despatch 22-12-17, "Am much indebted...to Lieut. Gibbings, ... who was wounded when advancing against the guns".

GIBBINGS, Robert. Mad. Inf.
b. 24-7-1793. d. 12-4-26, at sea, off Mangalore.

Ens. 19-8-09 ... Capt. 1-5-24.

Twin bro. of John [*sup*].

m., Oct. 1822, Frances, dau. of Maj. Henry Yarde, Mad. Eur.

July 1815, MMI., cl. IX [II, 321]; 15-10-16, under orders of Nāgpur Subsy. Force, to be employed on svy. under AQMG., survg. passes in Nāgpur territories [83]; MGO. 17-3-17, on svy. in Berār under SG.

6-4-18, to act as AQMG. to Div. at Mhow; 13-10-18, applies for compensation for horse belonging to his bro. John, lost at Mehidpur; 20-10-18, confirmed as AQMG. 1817-9, signs many maps as AQMG. including MRIO. 188 (35) shewing Asirgarh Fort.

Svy. Narbada R., fdbks., MRIO. M 344, 401, embodied in Malcolm's map of Mālwa, 1818-9 [84].

GIBSON, George. Adventurer.
b. Madras. d. of cholera, 10-3-25, on road Rangoon to Prome[7].

Son of English sea-captain and Telinga mother. "His father seems to have been a mercenary Captain in the service of Indian rulers, and lost his life in the Bay of Bengal". ...

"Education...at Ngabek, a Catholic [mission] settlement... north-west of Amarapura, where he learnt to write and speak English, Portuguese, a little French, and some oriental dialects, specially Telinga". "He had read works on ancient history, and possessed a fund of general knowledge.

"He had made two voyages to Lisbon, and had commanded several vessels. In a small Danish brig...he visited Cochin China in the years 1795. ... About 1795, he seems to have constructed one ship of three hundred tons for the...Princes Royal [Ava] and afterwards floated her down to Rangoon. ...

"His interest in geographical and commercial pursuits had caused him to explore...the Burmese dominions. ... He was frequently employed by Ga-gyi-daw and his grandfather in compiling maps... from the charts and descriptive accounts drawn up by the King's subjects. ... He had held situations of trust, and...enjoyed considerable favour.

"He was intimately acquainted with language, customs, and manners of the Burmese people, the nature and resources of its Government, and the character...of its King and principal ministers"[8].

After the Burmese invasions of Assam, 1817 and 1819, Gibson was called on "to construct a map of Burma, together with the adjacent countries of India, Siam, and Cochin China. On looking at the map the King remarked that he had assigned too much territory to the English, and that Assam would be a desirable acquisition for the Burmese to make"[9] [52].

Deputed on pol. mission to Saigon to enlist support of Cochin-China to Burmese attack on Siam, Gibson left Ava 21-7-22, and reached Rangoon 9-8-22. Left Rangoon Jan. 1823, and reached PWI. 26th Feb. His ship was destroyed by fire in Penang harbour 24th March. Assisted by loan from British Govt. at PWI. the mission left in Portuguese ship 22-4-23, and reached Saigon 8th June.

The King of Cochin-China then resided at Hué, and Gibson's mission dealt with the viceroy at Saigon, who after nine months delay conveyed an unfavourable reply. By the time that Gibson returned to PWI., the British were at war with Burma, and he offered his services to the Resdt.,[10] who passed him to Burney to assist in construction of map of Burma [79-80, 431].

At Burney's request Gibson wrote a journal of his mission to Saigon, a rough copy of which, probably by Burney, is

[1] MRIO. Misc. 16-0-33. [2] Lloyd (283-6). [3] ib. (pref. v, vi). [4] Journal, 1819-20. [5] Robt. Ross (1789-1854), Comdg. 1st Nassiri Batt., Sabāthu, 1815-22; Hodson, III (697). [6] *JASB.* XII, 1843 (767). [7] Trant (159). [8] Saxena (147-8), *IHRC.* 1948. [9] Bhuyan (482). [10] John Crawfurd.

now preserved at Delhi[1]. Crawfurd records that Gibson's original "was replete with errors in grammar and orthography in every line, and...nearly unintelligible without his own personal comments and explanations".

Burney spent nearly a month extracting all the geogl. infn. about Burma and its neighbouring countries that Gibson and his followers were able to furnish, and records that "although his private character and manners are by no means agreeable, ... yet I found he possessed much curious and really useful information regarding the Burma Government and country"[2].

When the map was sent to Calcutta to be printed, a copy was sent with Gibson to the Army at Rangoon where he made himself extremely useful to the staff, before his death on the advance towards Prome [71].

GILMORE, John. Ben. Engrs.
b. 20–7–11. d. Mhow, 24–8–47.

Lieut. 28–9–27; Capt. 29–12–43.
Son of Mungo Wm. Alder Gilmore, of Stamford Hill, London, sailmaker.
ed. Addiscombe, 1826–7. Hodson, II (269–70).
BGO. 11–12–29, appd. to svy. line for Grand Trunk Rd. Burdwān to Patna; reported completion 22–3–30 [28, 493].
MRIO. 46 (5), 1831, survd. road to Balasore.

GORDON, George Lawrie. Ben. Inf.
b. 25–3–01. d. Manipur, 30–12–44, MI.

Ens. 24–7–19 ... Capt. 8–1–38.
Son of Rev. Dr. George Gordon, MD., minister of Sorn, co. Ayr, and Ann his wife, dau. of Rev. Geo. Lawrie.
ed. Glasgow. Hodson, II (286).
1824–5, serving with Pioneers; Adjt. Gambhir Singh's Levy in Manipur; 12–11–25 to 11–2–35, 2nd in comd.

9–4–27, joined Pemberton as Asst. Survr., Rs. 250 pm., on Manipur–Burma border, on SG.'s recdn.; "The researches of Lieut. Pemberton would be materially aided if an officer were appointed to be his assistant, ... and Lieut. Gordon—...formerly in the Pioneers, and now adjutant in Gumbeer Singh's Levy, which is supposed to be reduced in the course of the next month—...is on the spot, and might...be promptly and profitably employed.

"Lieut. Pemberton represents him as a gentleman of considerable talent, who has already acquired a competent knowledge of the language...of the country, and...possesses in a remarkable degree the qualities which are likely to ensure... enterprize...and ardour. Lieut. Gordon has not yet had experience in surveying, but...would prove a useful assistant, and...in such remote and wild fields of operation, and where great danger to health is incurred, the advantages of employing two officers are too obvious"[3] [66].

Pemberton reported a few months later that Gordon "has already qualified himself to undertake the reduction of the traverses; and I am indebted to him...for cordial assistance on every other occasion"[4] [199]. MRIO. 36 (47–9) route svys. Manipur to Assam.

1832, Survr. with mission led by Jenkins[5] and Pemberton, and from Feb. 1835 PA. Manipur. Compiled English-Bengali-Manipur dictionary, pub. 1837.

GORDON, John William. Bo. Inf.
b. 11–2–04. d. Nīlgiri Hills, 23–7–39.

Lieut. 13–8–20; Capt. 20–12–33.
Son of George and Sophia Gordon.
28–6–21, appd. Asst., Survr.; Deccan Svy.; 25–10–23, resd. appt. as Asst. Survr. 1st cl. [125 n.12].
Dec. 1829, serving with cav. of Nizām's army till death.

GOWAN, Edward Parry. Ben. Art.
b. 10–7–1791. d. Simla, 10–2–40.

Lt. Fwkr. 14–9–10 ... Capt. 29–8–34; Bt Maj. 28–6–38.
Son of George Gowan, merch. of Calcutta, formerly Ben. Inf. (1773–89), and Mary Parry his wife.
ed. Addiscombe 1809–10. Hodson, II (298).
Dec. 1818 to May 1819, survd. route of Lt. Col. Ludlow's[6] dett. to Nimach and Mhow.
1818–23, with 4th Troop, Horse Art.

GRAFTON, Augustus. Bo. Inf.
b. 29–2–1788. d. 17–4–60.

Mdpn. Bo. Mar. 25–8–03; Bo. Mar. Batt. 1804; Lieut. 18–9–06; 1–1–18 tr. to Bo. Inf. as Capt.; Maj. 25–5–29; ret. 29–12–31; Hon. Lt Col. Nov. 1854.
Son of C. E. Grafton.
m., Walcot, Bath 5–8–34, Mary Nicholson, dau. of Wm. Robertson of Demerara, WI.

1818, operations in Konkan as Bt. Capt.; 1–3–19, appd. Asst. Survr., with Jopp on trgn. (125 n.12, 129); 19–1–28, appd. to ch. Deccan Svy. [126]; 1828–9, with Shortrede on meast. of base-line nr. Karli [130]; 31–5–30, Deccan Svy. closed down.

A notebook has been found at Dehra Dūn, initialed A.G., which gives route svys. round Kalyan, in N. Konkan and sketches of Satāra, 1818–9, obviously Grafton's. It commences 17–3–18 at Kalyan, and passes through *Mullinghur—Wurrie—Wanuza—Parle—Panwell—Terrapoor*. 6th April; "The villages about here are miserably off for inhabitants and supplies, and there are very few and not one good village between this & the coast".

There are little sketches of hills and forts. "From the top of *Juggwah* the whole country as far as the eye could search appeared to be a jungle and hills". On 6th May report of a "Royal Tiger". The season's tours close on 20th June.

Working season re-opened 25th Oct.—*Callian* to *Bhane—Wounza—Panwell*—closing at "cantonments near Callian. ... This route was with Chinumjee Appa, the Paishwah's brother". 17th Nov. from Panwell to Tannah by boat "with Cherry".

Several pages contain neat pencil sketches of Satāra—"Bearings from the terrace of my house"—"Bearings from the Durgah...to Shipkee's house 3 f. 20 poles. ... Little's—Mansfield's—Grafton's".

There is a rough sketch of "an intelligent peon at Penn", and a note recording disapproval of "Catholic Emancipation"[7].

GRANT, Peter Warden. Ben. Inf.
b. 2–12–1794. d. at sea, 7–4–28, on voyage to China.

Ens. 1–5–12 ... Capt. 13–5–25.
Son of Alexander Grant, merch., of Forres, NB.

[1] Karpeles (150–7). *IHRC.* 1948. [2] HMS. 663 (728), 22–10–24. [3] DDn. 204 (307), 2–3–27. [4] ib. (323), 3–5–27. [5] Francis Jenkins b. 1793; Ben. Inf. 1811–61; Hodson, II (549). [6] John Ludlow (1773–1821) Ben. Inf., Ens. 1794; Lt Col. 1817; comdg. Nimach Fd. Force 1819 till death, Kotah State. [7] GBO. Comp. B–1–14; Kalyan 30 m. NE. from Bombay; Panvel 20 m. E.; Pen, 20 m. s. of Panvel. Malangad, hill fortress visible from Bombay I.—*Wanunza* pr. Vanaje—Parle pr. Pale Budruk. Other places lie in N. area of Thāna Dist.; John Hector Cherry, Bo CS. 1812 till death 1824, was Asst. Collr. N. Konkan, 1819. *Shipkee* pr. Francis Sheppee (1791–1863), Asst. Surg., 9th Bo NI. 1819—James L. Little, Bo. Eur. Regt.

m., St. Andrew's ch., Calcutta, 31-5-23, Eliza, dau. of Alex. Fraser, merch. of Forres, and sister of Robt. Warden Fraser; Ben. Inf.

Hodson, II (321); III (787).

1813-4, at Ft. Wm. Coll., Calcutta; 1814-5, Nepāl War.

Aug. 1817, submitted map of N. frontier of Gorakhpur with Nepāl, having survd. part himself [19, 178-9]; BJC. 5-9-17 & BGO. 7-10-17, appd. to svy. W. frontier of Azamgarh and Jaunpur with Oudh, extending svy. along W. frontier of Gorakhpur [19-22].

2-12-18, ordered by Resdt. Lucknow[1] to svy. N. frontier of Oudh with Nepāl; continued svy. and erection of pillars during 1819 and up to June 1820; submitted final maps in March [22, 361]. For part of this time he bore the added responsibility of Comnr. in the interests of Oudh, and the svy. was much interrupted by difficult co-operation with "Goorkha agents". The Resdt. writes, 12-3-19, expressing

"entire approbation of your proceedings. ... The zeal, temper, and judgment which you have displayed has...contributed in a great measure to allay the feelings of the Commissioners, which if not constrained by your prudence and discretion might have burst forth into serious opposition".

This was later endorsed by the actg. Resdt.; "The share you took in the business was...highly judicious and proper, and I join cordially in the opinion which Mr. Monckton has expressed on the ability of your reports, which appear to have left no point unnoticed that is essential to the forming of a satisfactory judgement"[2].

A notice in *Govt. Gaz.* 24-2-20 records that "From the last Indian Gazette we learn that Lieut. P. W. Grant, surveyor, has adjusted the late disputes subsisting between the Durbars of Katmandoo and His Majesty the King of Oude in the most able, satisfactory, and amicable manner".

Grant justifies the slowness of his operations; "I will not court praise by exaggerating the difficulties, ... but I deprecate censure because, although there is nothing in them either difficult or harrassing, yet they were...attended with greater difficulties and greater responsibilities. ... The surveys are by no means so extensive and complete as might have been expected had my time and attention been devoted entirely to the surveys alone. ...

"It may perhaps be a source of regret that the combined duties of surveyor and British Commissioner...will exclude me from that early distinction in the Survey Department which others have obtained. ... The duties immediately assigned to me are not of that description which are likely to afford much scope for scientific enquiry"[3].

He drew no extra pay for duty as Boundary Comnr.

BGO. 14-9-21, appd. to ch. rev. svy. of Gorakhpur and commenced work in Jan. 1822 in *pargana* Amorha [22, 151-2, 159, 216-7, 221, 333, 388]. March 1823 submitted mc.; "I had been compelled early in January to relinquish the survey, and to return to the station in company with Doctor Graham[4]; ...

"My further stay in this district affords no prospect of immediate, and far less of any permanent, amendment in the state of my health, and I...proceed to the river immediately, as the only means of affording even a temporary relief from a disorder which baffles the powers of medicine. ... Unless the river air shall produce a speedy and decided alteration for the better, my proceeding to the Presidency will then... be no longer a question of mere propriety, but of necessity.

"It is accordingly my intention to proceed immediately on the river under charge of Doctor Graham, who proceeds to the Presidency. ... It is to be hoped that before the ensuing cold season my health will be sufficiently restored to admit of my rejoining & taking a more active part in...the survey than I have been able to do during the present season"[5].

Leaving Wroughton in ch., Grant went down to Calcutta, and sailed on mc. to the Cape in June 1823[6], and after several extensions returned 12-5-25. Blacker welcomed him back as just the man take ch. of the Astr. Svy. recently sanctioned [185], pointing out that at the Cape, ... "during nearly two years he resided with the Reverend Mr. Fellows [183 n.7, 332, 447], the astronomer sent by the Royal Society, and applied with assiduity to the...practice of astronomy. I have discussed with him the principal objects of that branch of science, in which he evinces a competent knowledge and, to try him further, I have employed him in some reductions and calculations of practical use, with which he appears to be sufficiently familiar"[7].

About this time he wrote a paper on lunar obsns. for longitude [183]. He kept a considerable library of prof. books, and one of these, *Phil Trans.* 1818, containing Lambton's account of his Great Arc, is now in GBO. Library, and bears his autograph [175, 187, 216, 294 n.7].

The proposed astr. svy. for Bengal did not materialize, and under BGO. 17-6-25, Grant was placed at disposal of C-in-C. for mil. service in Burma, for ch. of svys. to be based on astr. control [181, 183-5, 205-6, 213-4, 218, 333, 395, 463]. Sailing from Calcutta 28-6-25, with a number of insts. recently received from England, he spent 3 mo. at Rangoon taking obsns. for lat. and long., and moved up to Prome in Oct., and further up the river in Feb. 1826, to complete svys. as far as Amarapura [371-3, 216-8, 313 n.4, 427, 507]. After the conclusion of peace went by sea to Amherst in a small sailing boat, failing in an adventurous attempt to force his way up the mouth of the Sittang R.[8] [74-5].

From Amherst he made a trip by boat up the Salween, and in June, after fixing several geogl. positions, returned to Calcutta where he spent the rains working up results [75-6].

Being now deputed to svy. the newly won province of Tenasserim, he returned to Amherst 19-1-27; fixed the position of Moulmein, and with the asstce. of De Montmorency spent the next ten months survg. the main features, mostly by boat along the rivers. He spent the rains at Moulmein, and suffered severely from malaria. Handing over to De Montmorency in Oct. he returned to Calcutta in Dec. [t-page, 76-7, 199-200, 269, 400].

Writes to SG. 1-1-28; "The medical certificate...will have apprized you of the painful circumstances under which I was compelled to quit Martaban. I remained in that province much longer than perhaps I ought to have done, in the hope that the change of season would bring with it an improved state of health, but my hopes proved delusive, and nothing but a change of air appeared calculated to remove the rheumatic diathesis, from which I have suffered since my exposure on the Gayen River. ... I have already derived more benefit than I expected, ... and I hope in a few weeks to recover the use of my limbs"[9].

Again, 16-2-28; "My health is certainly very good considering my long confinement. My face is becoming gradually more flexible. I require warm weather, and when I am once able to use crutches and move about a little, I have no doubt of rapidly recovering. I suffer much from the cold which compels me to keep to bed, in consequence of which I am obliged to take more medicine. ...

1 John Monckton (1779-1852); BCS.; *OW.*, II (652). 2 DDn. 153 (152-3). 3 to SG.; DDn. 153 (13), 15-10-19. 4 Wm. Graham (1795-1843); Ben. Med.; Crawford's *Roll* (B. 926). 5 to SG. 8-3-23; BTC. 29-3-23 (65). 6 BGO. 13-6-23 (35). 7 DDn. 204 (161), 1-6-25. 8 cf. Findlay (953). 9 DDn. 220 (303).

"The disease is always a tedious one, and has laid so firm a hold of my limbs, that...I do not think...I shall be able to resume active duties...this season; and, even if I should be able to do so, it would not be advisable for me to attempt it. Medicine has proved altogether fruitless, and the Doctor tells me that there is nothing for it but patience and, when I am able, to go to sea for 2 or 3 months[1].

Under BGO. 21-3-28, granted 7 mo. leave on mc., for sea voyage to China.

Hodgson refused him permission to take papers of the svy. with him; "The materials must be left here, such as they are, and when you return you must adjust them", on which Grant sent in everything "public and private regarding the survey, in a tin box, in case I should walk off the stage, but I hope to have some years yet.

"It has been my misfortune to fall a victim to an insidious disease in a pestilential country. The labourer deserves his hire, yet he makes but a poor matter of it who, at the end of a twelve-month, not only loses his allowances 2/3, but loses also that which is much more precious, his health. However, my case is only like that of others in the Department, bettered, however, in every instance by your extreme kindness and indulgence. ...

"I have never enjoyed one day's good health in Martaban, owing to some unaccountable fatality. Upon due consideration of what you say, I think it will be advisable to suspend the survey altogether till I rejoin. I am in a miserable state of weakness, and sitting up yesterday and today to write has almost killed me. I am sorry you are precluded from seeing me, but the gout is a respectable, honorable, & gentlemanly disease, whereas mine is only fit for rustics and the vulgar. However, I must live in hopes of better days"[2].

19-3-28, after Grant had embarked, Hodgson sent him a hurried note; "I had no idea you were going away so suddenly, as I saw by the papers that your ship was to remain till after the opium sales. Had you remained over tomorrow I would have called on you, as I am better though rather lame [460-1]. I have received the papers and instruments. ... Accept my best wishes for a complete and speedy recovery"[3].

Grant sailed in the *Isabella Robertson*, and d. before she reached Singapore.

In his will he left his property to his wife or, "if she were to die first, then one half to Catherine Moore, sister of John Moore of Calcutta; one fourth to William Fraser, brother of my wife Eliza; remaining fourth to James Grant[4] of the town of Calcutta"[5].

HADAWAY, John. Ben. Inf.
b. 3-7-1787. d., unm., Calcutta, 21-4-23; MI. S. Park St. cem.

Ens. 27-10-10; Lieut. 18-2-15.

Son of Patrick Hadaway, of Leith, brewer, and Janet his wife.

Hodson, II (353).

1821, with Bedford at Morādabād in 24th NI.; on local svys. under magte.; 27-11-21, appd. Asst. Survr. on rev. svy. [152-4, 332]. 19-12-22, promoted Survr. but on sick list proceeding "to the Presidency for medical advice".

d. at residence of SG. in Chowringhee, "having been the sole support of his aged mother (a widow, in very indigent circumstances, residing at Leith)"[6].

HALL, Henry. Ben. Inf.
b. 11-9-1789. d. 22-7-75.

Ens. 21-10-05 ... Gen. 23-7-66.

Son of Ven. Francis Hall, LLD., of co. Galway, and Christian Traill his wife.

m., Nasirābād, 3-10-27, Sara, dau. of Christopher Fagan.

DIB.; Hodson, II (364-5).

1-1-17, appd. DAQMG. 2nd cl., *whilst with* Reserve, Grand Army; 1822, raised Merwara Batt.,[7] comdg. it till 1835; svys. in Rājputāna, Sheikāwati, and Ajmer [87, 335].

HALL, William Joseph Osborne. Ben. Engrs.
b. 11-9-1791. d., unm., 14-12-17, Hoshangābād.

Ens. 4-11-09; Lieut. 1817.

Son of Rev. Dr. William Hall, of Shadwell, London, and Frances Eastcourt his wife.

ed. Merchant Taylors. Hodson, II (366).

6-12-16, appd. Fd. Engr. to Nāgpur Subsy. Force; MRIO. M 334, survd. routes of this force, 1817 [83-4].

HAMMOND, James John. Mad. Inf.
b. 4-1-1791. d. 5-9-78.

Ens. 27-6-06 ... Capt. 1-5-24; ret. 8-5-32; Hon. Maj. 28-11-54.

Son of Thomas and Susannah Hammond.

m., Edmonton, England, 18-1-36, Anne, dau. of Rev. Dawson Warren.

July 1813, MMI. cl. VII [II, 321].

MGO. 16-12-25, Survr. 1st. cl., in svy. branch, QMG.'s Dept.; "with Madras troops in Ava, from 1-11-25; with Crawfurd to Amherst, and helped in lay-out of new town [74]: *Ben Regr.* 482 (75), 1826, river svy. Prome to Yandaboo.

HANSARD, Reginald William Kemeys. Mad. Inf.
b. 26-4-1792. d. London 30-9-20.

Ens. 3-7-07; Lieut. 2-7-13.

Son of Providence and Jane Hansard, of Bristol.

MGO. 7-3-09, resd. from MMI. without actual joining.

1818-9, survd. Narbada R., and routes for Malcolm [84, 123]; MGO. 7-4-19, allowed sea-voyage on mc. by Bo. Govt.; ib. 18-4-20 leave on mc. for 3 years.

HART, Henry. Bo. Inf.
b. 29-12-02. d. unm. 1860.

Ens. 12-5-21 ... Capt. 8-10-39; resd. 26-6-40.

Son of Lt. Gen. Geo. Vaughan Hart, of Kilderry, Ireland, MP., and Charlotte his wife.

c. Aug. 1825, appd. to Deccan Svy [168 n.2].

HEMMING, Samuel. Bo. Engrs.
b. 11-8-1799. d. 31-10-76.

Ens. 26-1-19; resd. 28-11-22; ret. 18-10-26.

Son of Rev. Samuel Hemming, of Teddington.

m., Stellenbosch, SA., 29-9-20, Agnes Baird, niece of Sir David Baird, Bart. [II, 460], late Govr. Cape Colony, and probably dau. of M. Gen. Joseph Baird, who d. at Cape 4-4-16.

Bo GO. 17-1-18, to be Asst. on Deccan Svy. [125 n.2].

HENRY, Maurice Sauvigny. French Corps des Ingénieurs-géographes.
b. 31-5-1763. d. 25-4-25.

Appd. 1793; 3-11-09, confirmed as Col. in corps; ret. 1825.

Dict. Générale; Service Géographique.

1802, after being obsy. Director, Mannheim & St. Petersburg, deputed to Bavaria as Chef du Bureau Topographique; measured base, and obsd. lat., of Munich by June 1802.

1803-8, held ch. of geodetic and topo. svy. of Switzerland; 1809, with Tranchot, obsd. principal series of triangles, Dunkirk to Mont Tonnerre; 1813, employed by Bureau des

[1] DDn. 221 (278-80). [2] ib. (216-9), 15-3-28. [3] DDn. 220 (326). [4] probably James Wm. Grant [458 n.8]. [5] Will sd. 23-12-26; Ben. Wills, 1828. [6] BTC. 22-5-23 (58). [7] *Imp Gaz.* (310).

Longitudes on obsns. along parallel of Paris, and on principal series Dunkirk–Gotha; Nov. 1813, appd. to Depot de la Guerre.

May 1814, Chef de la brigade de l'est, hdqrs. Strasburg.

1816, recalled to Paris for ch. of compns.

22-10-17, on re-organization of Corps Royal des Ingénieurs Géographes, retained on the active list with rank of Colonel.

Auth. of *Mémoire sur la Projection des Cartes géographiques adoptée au Depôt Général de la Guerre*, 1810; *Précis d'un traité de Trigonométrie Sphérique*, 1816.

His projection for the Military Map of France, or "projection modifiée de Flamsteed", as described by Puissant, adapted by Blacker for the Atlas of India [294–5, 424].

HERBERT, James Dowling [II, 405].
Ben. Inf.
b. Aug. 1791. d. Lucknow, 25-9-33.

Ens. 18-3-08 ... Capt. 3-6-22.

Son of James Dowling Herbert, of Dublin, and later of London.

m., Calcutta, 28-4-23, Mary Manson, probably sister of James Manson [484]; she d. 2-2-88, aged 88; had one dau., Clara Josephine.

Hodson, II (434); III (727); *As R.* XVIII (227 *et seq*); *JASB.* XI, 1842 (i-clxiii, 273, 583-4, 603); XIII, 1844 (734-64).

Nepāl War, 1814, route svys. with 1/8th NI. [II, 198 n.7].

"In 1815, when with my corps on the Goruckpore and Betwah frontiers, I determined...an elevation of 27,000 feet—Dhawla-giri, or the White Mountain—...fixed by Webb and Blake [II, 87]. ... I consider my measurement as less exceptionable than either of these. ... The position...depends on a triangulation established from a base of 1,142 feet measured with a chain; ... angles measured by sextant, both horizontal and vertical. A much nearer approach to the peak was made, one of the stations being distant only seventy miles"[1].

BMC. 15-11-16 (150), at Hodgson's request appd. Asst. Survr. on Himālaya svy., salary Rs. 100 pm.; travelling up from Calcutta, joined Hodgson at Raithal [32–3] 10-5-17, and reached Gangotri, the reputed source of the Ganges on 26th [33–4, 460].

Spent rains of 1817 with Hodgson at Sahāranpur, moving up to Chaur peak in Oct. to take reciprocal obsns. [34]. Obtained leave to rejoin batt. on service against Marāthas; "Lieut. Herbert, knowing that his corps was on service with a small complement of officers, volunteered to join it; his offer was accepted, and he proceeded at much expence and inconvenience to the Centre Division. I expect him to join me every day, when I will give him his instructions as to making...observations in the Sirmoor mountains"[2]. On his journey back robbed of his chronometer "in the vicinity of Gwalior" [218].

April 1818, returned to the hills, obsg. on Bhadrāj, and then joining Hodgson at Nāhan [34]. Hodgson writes, 27-5-18; "Herbert's health is also precarious, and he has had lately a very dangerous attack of jungle fever, and I greatly fear he may be obliged to go to sea"[3]. He had recovered by the end of month, and marched with Hodgson to Sabāthu, visiting the Chaur and the headwaters of the Tons on the way. Hodgson now went sick and handed over to Herbert, who spent June and July on compns. at Kotgarh where his batt. was stationed [2, 35, 303, 328, 354–5].

Leaving Kotgarh 31-7-18, marched across the headwaters of Tons and Jumna[4], and explored upper feeders of the Ganges above Gangotri and N. of the main Himālayan range, being stopped at village of Nelāng [36, 221]. Continuing svy. and obsns. descended the Bhāgīrathi, crossed to Dehra, and arrd. Sahāranpur 20-11-18. Spent next 4 mo. on meast. of base-line in the Dūn, completed March 1819 [2, 37, 177, 197–8, 204; pl. 5 n.].

1819, survd. through hills N. of Landour, reaching Kotgarh in June to spend rains there [37, 196–7]. From 1st Sept. spent 10 weeks with Patrick Gerard in Sutlej valley [42–3, 272, 453], after which delightful trip he worked down to Sabāthu and across to Nāhan, where he was joined by a new asst., Thomas Oliver [491], and then worked across lower hills to the Ganges at Rikhikesh. Spent rains of 1820 at Sahāranpur with Hodgson on final maps and reports, the latter being pub. in *As R.* of 1822 [38–9, 355–6, 460–1, pl. 5].

There had been some delay in official notification of his appt. to succ. Hodgson as Survr. in ch., and he writes earnestly to SG. craving for favourable decision; "Having learned of the appointment of Captain Hodgson to the command of escort attached to the Resdcy. at the Court of Holkar, by which the situation...of Surveyor becomes vacant, I...bring to your notice my claims to succeed. ...

"In January 1817 I was appointed Captain Hodgson's assistant, since when I have been constantly and indefatigably employed, except during the short period in which I was permitted to join my corps, then on service; and, even then, all my spare time was devoted to subjects connected with the survey [451].

"I have given this subject the most unremitted attention. ... I have been led into a course of reading and study by which...I have much increased my stock of mathematical knowledge. It would be a severe disappointment...to find that all this study had become futile. ... I have heard of the intention of Government to appoint Captain Webb to finish the survey. To remain attached...as that officer's assistant is what I could not do[5] [329].

All was well and, under Govt. letter of 7-8-19, he was authorised "to draw the usual allowance of a mountain surveyor from the 10th of August last, the date on which the charge of the survey actually devolved on him"[6] [346].

BGO. 11-9-21, at Hodgson's request, appd., to succeed Hyde as ASG. and after handing over to Oliver travelled down to Calcutta by river, and took ch. of SGO. 19-12-21 [305, 309, 462].

27-2-23, appd. to ch. of geol. svy. of the Himālaya from which great results were expected [268, 309, 433, 436]. He started field work in Jan. 1824, and was joined by his bro-in-law, James Manson, as asst.

Early in 1828 Hodgson asked for his recall to Calcutta as ASG. [310]. He was on tour to NW. of the Jumna at the time, and his last journal describes his march "from Dehra Doon to Suharunpoor, Meeruth, Moradabad, Ganges Ghat, and down the river to Calcutta. ... On his way down he narrowly escaped drowning at Colgong[7] [269].

His preliminary report on the geol. svy. dealt with minerals only, and his map appreciated as "the only connected geological sketch we have of this great and interesting tract. ... The report itself was but a first one and, ... like the map, but a sketch of what more detailed...examination are wanting to render perfect" [268 ns. 6, 9]. He left the rest of his journals and notes uncompleted, and it was not till several years after his death that they were discovered, edited by John Batten, BCS., and pub. in 1844 by ASB. [268 n.8][8].

[1] Webb's height 26,862, modern maps 26,795. Herbert's Mineralogical Report of 1828; *JASB.* XI, 1842, part 126. (xxi–ii). [2] from Hodgson, Feb. 1818, DDn. 157 (7). [3] DDn. 152 (50). [4] Route map, Kotgarh to Kedarnath, MRIO. 13. (29). [5] DDn. 152 (100), 14-10-19. [6] DDn. 144 (299); acknowledged by Herbert's letter of 12-12-19, DDn. 132 (155). [7] about 18 m. below Bhāgalpur [I, 64]. [8] *JASB.* X, 1841 (415); XI 1842 (1138).

A tribute to his work in the Himālaya is paid by the botanist Griffith, who suggested that there should be a *Pinus Herbertiana*[1].

From 30-5-28 to 23-1-29, ASG. at Calcutta, and on Hodgson's departure acted as SG. on full allces.; on Walpole's appt., 14-9-29 became DSG. Bengal & Supt. of Rev. Svys. [8, 151, 293, 301, 306]. Bentinck had seriously considered him for appt. as SG. [301].

Hodgson had suggested in 1828 that if Everest was unable to return to India for ch. of the GTS., Herbert was "qualified to undertake the duty", but the matter had not been pursued [242, 308, 445-6][2].

In 1830 probably at Bentinck's request Herbert pub. a pamphlet advocating the better control of rev. svys. by regular trgn.[3]. Everest submitted a copy to Govt., 29-9-32; "The system pursued by the Revenue Survey Department in India is one of the most unscientific, dilatory, and therefore costly, methods that could be devised, and I am borne out in that opinion by my late able Deputy, Captain Herbert, ... whose printed work on the subject I take the liberty to enclose, ... wherein that subject is very cleverly handled, and...the judgement of a person of so much experience in the practical part of that sort of work is no mean criterion"[4].

With James Prinsep, Herbert took a leading part in the activities of the ASB. during his stay in Calcutta. In 1829 he started and edited a new monthly pubn. entitled *Gleanings in Science*; "His primary idea was to confine it to extracts and abstracts from European scientific publications, but original contributions poured in so rapidly that he had to abstain from extracts". He issued 3 vols., the last, 1831, being completed by Prinsep, under whose direction the title was changed to *Journal of the Asiatic Society*[5] [495].

Vol. II contains account of his visit to Darjeeling[6]; "Favorable accounts having reached Government of the climate of the Siccim country, and of the advantages which would attend the establishment of a sanatorium or station of health at Darjiling, it was suggested to me that my personal examination of the spot might lead to a more correct appreciation". ... Accompanied by James Grant of Malda[7], spent a month away from Calcutta on this visit. They reported most favourably and strongly advocated its occupation. *JASB.* XVII, 1848 (644-6) mentions a "Herbert Hill" at Darjeeling.

The preface of vol. III was the first to bear initials J. D. H., and gives reason for pubn.; "The present...volume... is the last, and was succeeded by a periodical 'The Journal of the Asiatic Society'. ... The regular Transactions of that society appear in too bulky and expensive a shape to afford sufficient information to the European world. The volumes do not appear oftener than once in five or six years, and expense restricts purchase almost entirely to the possessors of large libraries"[8].

During 1832 was nominated, together with Prinsep and others, to form an Indian Committee of the *British Association for the promotion of Science*[9]. Attended rev. svy. conference at Allahābād, Jan 1833, drawing Rs. 181-12-0 for travelling expences from and to Lucknow.

After abandoning intention to take furl., was appd., Nov. 1831, to ch. of astr. obsy. at Lucknow; "The observatory was founded in the year 1832 by the late King of Oude, Nasar Uddin Hyder, and the first astronomer, Major Herbert, then Deputy Surveyor General, was chosen by Lord Bentinck on account of his eminent qualifications, and long and arduous services. ... Major Herbert, having made the preliminary arrangements at Lucknow, and ordered the requisite instrumental equipment from England, died in the year 1833"[10].

In lamenting his untimely death—here given as 24th Sept. —Prinsep notes that "he had been for some time suffering under the effects of the climate; a sudden determination of blood to the head was the immediate cause of the fatal event"[11].

HERVEY, Hervey Augustus. Bo. Inf.
b. 1-12-1786. d. 1824 drowned "off coast of Coromandel".

Ens. 14-9-04 ... Capt. 8-1-18.

Nat. son of Andrew Barnard—Sec. to Govt. Cape Town, *c.* 1797-1804, *v. Lady Anne Barnard at the Cape of Good Hope*[12], —and Margaret Millar, née Monerieff[13]; bro. of Andrew Hervey (1790-1862); Ben. Inf.; both bros. being given name Hervey when born in prison, Hodson, II (439).

m., 1st., Margaretta Adrians, who d. Bombay, 23-10-18.

m., 2nd., Calcutta, 29-11-19, Harriet Anne, dau. of Wm Barnfield.

MRIO. 124 (19), Map of Malvan, S. Konkan, scale 1 2/3 m. to inch, 1816; DDn. 278 (76) route to Gonka Ghāt, near Nursingpur.

HILL, Charles Thorold. Mad. Inf.
b. 19-2-09. d. London, 18-11-57.

Ens. 8-1-26 ... furl. 1842-5; Maj. 3-8-55; ret., as Hon. Lt.-Col.

Son of Henry Hill, Capt. RN., and Caroline Bettesworth his 2nd wife.

m., 29-8-44, Emma Harriet, dau. of Geo. Edw. Russell, MCS., Comnr. Ganjam; she d. Shanghai, 7-10-50.

MMC. 2-10-29, appd. Asst. Survr.; left Madras 21-10-29, *en route* to join N. Circārs svy. party. Snell reports, 1-4-30, "Ensign Hill having been now employed three months on independent field survey, I have much satisfaction in reporting his progress and proficiency as a surveyor. He draws neatly, and is careful and zealous in faithfully delineating the features and details of the country. Mr. Hill is also acquainted with the use of the theodolite"[14] [104, 342].

1845-51, with GTS.

HODGES, Alexander. Ben. Inf.
bapt. 24-8-1800. d. Lucknow, 6-9-41.

Ens. 4-3-20 ... Capt. 12-10-34 furl. 1836-40.

Son of Rev. Thomas Hodges, of Ludlow, Salop and Mary his wife.

m., Everton, 9-8-39, Hessy, dau. of Wm. Huffington, of co. Donegal.

Hodson, II (457).

15-7-14, 2/Lt. 3rd. Ceylon Foot.

BRC. 9-11-26 (60), appd. Asst. Rev. Survr. to Sahāranpur Rev. Svy., joining 6-1-27 [157, 334];

[1] *JASB.* VIII, 1839 (225). [2] DDn. 231 (85, 131), 4-2 & 14-6-28. [3] 24 pp., pub., Bapt. Mission Press, Calcutta 1830; *IO Tract.* 472. [4] DDn. 283 (162-5). [5] *JASB.*, I, tribute to Herbert by James Prinsep; *ASB. Cent. Rev.* 1885 (50); Evan Cotton (922). [6] *Gleanings in Science*, II, 1830 (89) cf. *Ben. P & P.* II (440-56). [7] Jas. Wm. Grant (1788-1865), BCS.; Comml. Resdt., Malda, 1822-33 [456 n.4]. [8] *Gleanings in Science*, III, 1831 (pref.). [9] Prinsep to Govt., 17-12-32, BGC., DDn. 222 (214). [10] from SG. 10-11-48; DDn. 462 (232). [11] *JASB.* II, 1833 (495). [12] by Dorothea Fairbridge, Oxford, 1924. [13] She m., New York, 1777, John Coghlan, Capt., 89th Ft.; pub. autobio. 1794. [14] from Vizagapatam Dist., DDn. 237 (223), 1-4-30.

Jan. 1828, to rev. svy. of Sundarbans, holding ch. till 1835 [41–2, 144, 370].

Ben. Regr. 18 (19) 98 (282–304, 315–40) ; *New & Improved Map of Sunderbunds*, 4 inches to mile 1829 ; 2 inches to mile ; lithd. 1831 ; Rs. 23.

HODGES, Richard Harris. Mad. Inf.
b. 1791. d. Masulipatam, 7–7–20.

Ens. 3–7–07 ... Lieut. 1–6–15.

Son of Isaac and Elizabeth Hodges of Wells, Somerset.

MGO. 13–12–08, posted to MMI ; 18–2–09, to rejoin unit [II, 320–1]. MMC. 7–2–12, leave to sea for benefit of health ; July 1813, MMI. cl. VII [II, 321].

MGO. 7–8–16, 4 mo. leave to Bengal to visit bro., pr. Edw. H., ship's officer 1805–12, and possibly planter or merch. in Bengal later ; ib. 26–10–16, leave on mc. from Ft. Wm. to Europe ; re-admitted from 22–10–19, on arrl. Bengal instead of Madras "owing to contrary winds and stress of weather"[1].

Early in 1820, on return to Madras, posted, to ch. of svy., N. Circārs supdg. meast. of base-line near Ellore [101]. d., shortly after [5, 341], Mackenzie writting from Calcutta, 23–9–20, "I have been much distressed by poor Mr. Hodge's death [*sic*] ; this coming so soon after Capt. Garling's is a shock to the survey [450]. ... I had seen [him] in Calcutta last year, and from what little I saw of him, I was much impressed in his favour. Two of the ladies that came out in the ship with him are here, and lamented exceedingly his early fate. As he had been just returned from a voyage of convalescence, it was a pity he adventured so early into those hills"[2].

HODGSON, John Anthony [II, 407–8].
b. 2–7–1777. d. Ambala, 28–3–48 ; MI.

Ens. 19–1–1800 ... MGen. 3–11–41.

SG. of India, 1821–3 ; 1826–9.

Son of George Hodgson, of Bishop Auckland, co. Durham.

m., Calcutta, 6–2–22, Matilda Emily Anne, dau. of Thos. Norris, and widow of Capt. G. F. Harriot (1780–1818), Ben. Inf. ; she d. Calcutta, 28–11–28, aged 32.

ed. Durham city Grammar School, and intended for legal career.

Hodson II (460) ; *Oriental Club* ; *RAS.* (*mn.*) IX. 1849 (59–61). Portrait, pl. 21.

March 1800, arrd. India ; 1809–10, survd. mil. routes Ludhiāna–Hariāna [II, 64–5 ; III, 24].

1813–4, Asst. to Francis White on svy. of upper *doāb* Aligarh to Sahāranpur ; took over ch., Oct. 1813, and survd. into Dūn [II, 37–8, 82–4]. Took obsns. from Bhadrāj *deota*[3] and cut initials on rock [pl. 5 reverse]. July 1814, to Calcutta, and appd. Survr. to Dinapore column advancing against Nepāl, having but little opportunity for useful svy. [II, 40–2].

1815, much crippled by *tarai* fever, spent rains of 1815 at Muzaffarpur, Bihār ; ordered to Sahāranpur in Oct., with appt. as Survr. of the NW. mountain provinces, to the sources of their great rivers[4] [29].

MRIO. 575, writes to SG. from Muzaffarpur, 11–7–15, after the Gurkhas had been forced to evacuate the hills W. of the Kāli, and were hesitating over peace terms ; "I had a very handsome letter from the A.G. for the map & memoir sent. Col. Gardner [32 n.2]...says that if there be peace, it must be negotiated between Col. Bradshaw [II, 38, 43] & Gudraj Misser. The Nepalese hate Bradshaw cordially, & that may be a great impediment in negotiations. ... Should there be peace, I hope...to get away up to the new conquered provinces of Garhwal & Sirmoor, & effect the survey. ... There one may proceed without interruption from jealousy, & the exploration of the heads of the rivers is no mean object. Even were there peace, & I could get into Nepaul, the jealousy would be great, & I could not do a thing I wished".

He started with no detailed instns. ; Mackenzie was in Madras, and Crawford, who was shortly to go home on mc., writes, 28–10–15 ; "Having never been in that part of the country, ... and having the greatest dependence upon your well-known abilities, there is little or nothing left for me to say. ... You must therefore be...guided by your own judgement, upon which I place the fullest reliance"[5].

Travelling up-country by river, a slow business, Hodgson writes from Allāhābād, 1–10–15 ; "I arrived here today. I overtook the fleet of the 14th Regt., wh. it was impossible to pass in the strong waters wh. prevail. ... I have now passed the fleet, & hope to be at Cawnpore in 12 days, if the very strong NW., winds do not continue".

He reached Sahāranpur at end of Dec., and after sending out his 3 assts., Barton, Garstin, and Paton [451, 493] being himself delayed by fever, he worked through the Dūn and up to the Chaur Peak [2, 30 ; pl. 5]. He complains much of his health ; "On Baraut I suffered much from rheumatism & an inflamed sore throat, & the cold brought the latter to an alarming state, so that I cd. not speak nor swallow, & I was obliged to make the best of my way to Saharanpour for medical assistance, where I arrived on 5th March. ...

"On my arrival at Saharanpour I took such few observations as the thick weather & my ill-health wd. allow. ... I waited a few days more...hoping that the rain...might fall to clear the air so that the mountains might be fairly visible, but it did not [460], and the severity of my inflamed throat & rheumatism having somewhat abated, I set out on the 16th for Nahan, by the Sick country route already surveyed[6], & arrived on the 21st. Since my arrival here, the inflammation of my throat has returned most severely, & I suffer greatly, & not a little from the mortification of not being able to do what is my duty & ardent desire, for I dare not yet expose myself to the cold wind"[7].

He writes to Hyde from Kotgarh, 30–5–16, having camped near Simla on the way, telling him that he is "under the discipline of blisters for the violent inflammation of the glans [*sic*] of the throat, with which I am always attacked owing to the sudden transition of temperature. Snow & frost on the tops of the mountains, & thermometer 100° in the deep valleys. Tis hard to be so annoyed with any illness, as I have an interesting field before me ; the base of the Himalaya 28 or 30 miles distant"[8] [400].

He spent the summer months exploring the upper Sutlej valley, beyond the reach of the monsoon, and in the autumn revisited the Chaur to repeat obsns. to snow peaks, and those for lat. which were not giving that good agreement with his triangles that he had looked for [31–5, 175–7, 196] ; "I am doing all in my power to expedite and perfect the survey. I have been for a week past endeavouring to gain good observations on the top of this stormy peak, the Chaur Mountain, which is as high as Mount Etna, and which the freezing and tempestuous winds render a painful abode [30]"[9].

During the cold weather, when work in the hills became impossible, he moved down to Sahāranpur to repeat obsns. there, and then visited Webb in

[1] MMC. 13–12–19. [2] to Mountford ; DDn. 149 (141, 152). [3] holy place. [4] or Nālāgarh NW. of Kalka. [5] DDn. 131 (160). [6] Sikh States between Ambāla and hills. [7] Fdbk. MRIO. M 359 Feb. & March, 1816. [8] MRIO. M 575. [9] Chaur clearly visible from Simla, and Mussoorie 11,966 ft. [small meteorl. obsy. built by me nr. summit, 1902–3. B.H.P.] ; Etna, 10,870 ft. ; letter of 6–10–16 ; BMC. 15–11–16 (150, 159).

Rohilkhand to discuss a good junction with his svy. of Kumaun [32, 46].

He had now lost his 3 assts., who could not meet the heavy expense of supplies and transport in the hills on the small allce. of Rs. 100 pm. [346–7]. He moved into the hills again in the spring of 1817 with the intention of reaching the headwaters of both the Jumna and the Ganges, which had both been visited two years earlier by James Baillie Fraser[1] [II, 78]. A new asst., James Herbert, joined him on the road to Gangotri, the legendary Cow's Mouth, where the Bhāgīrathi issues from a glacier descending from the north side of the great snowy range[2] [33–4, 457 pl. 5].

Returning to Sahāranpur in June, they spent the rains on maps and compns. and, after taking more obsns. when the weather cleared, they got leave to join the Army, hoping for active mil. service [457].

Hodgson left Sahāranpur 10–11–17 and arrd. Delhi on 17th, where "I received orders to join the Reserve. I was obliged to halt a day to have leeches applied to my head, & to take equal altitudes of the sun for the chronometers. I have been extremely ill on the way from Saharanpour". Marching from Delhi on 19th, he survd. the route to Jaipur which was reached 10–12–17, and was asstd. in his lat. obsns. by his old friend Ezekiel Barton [II, 380–1 ; III, 29, 34][3]. He had to leave the army on 1st Jan. to resume his svy., and survd. a different return route via Alwar and Rewāri, "From Shamly I hurried 32 m. to Saharanpour, hoping that the rain which threatened to fall might clear the air, & enable me to see the snowy peaks more clearly than I could do during the late rainy season, when I took up my residency there for the sole purpose ; ... but during 3 months I only could observe them 2 or 3 times"[4].

He had great difficulty in persuading the SG. to pass his bills for the 3 mo. he was absent; Mackenzie had only recently come up from Madras, and did not like the way Hodgson had been taking orders from the mil. authorities rather than the SG.; Hodgson writes; "I will take great care to send any orders from the Commander-in-Chief[5] relating to myself or my assistant, and...acknowledge that I acted very irregularly in not more immediately and officially having reported to you that I had obtained the leave of His Excellency. ... Not thinking that the survey would suffer any material interruption for so short a time—and being advised...not to enter the hills during the 3 cold months on account of a severe affection of my head—...I applied to Head Quarters for leave...which was approved of. ...

I made observations on my march down to the Army, and observed when it marched. Seeing how extremely occupied the officers of the Quarter Master General's staff were, and that they had not leisure to make geographical surveys, I offered my services to Major General Sir D. Ochterlony, ... and carried on the survey in manner shewn by my field books. There was no formal order issued"[6].

Before taking the field again he withdrew to Karnāl for med. treatment; "In June 1817, being much exposed to sudden changes of climate, I was attacked by an inflammation and swelling of the membranes of my head and eyes which causes extreme suffering, and it is rarely that I can use my eyes or bear the light". He writes from Karnāl 1–3–18, "Lieut. Herbert will join me tomorrow[7], I expect, and will proceed immediately into the mountains. I am detained here by the gout, a painful disorder by which I am not able to move at present"[8] [456].

"When I re-entered the mountains in March 1818, I was suffering severely but—still entertaining a hope that I might recover—I remained in the hills, Lieutenant Herbert being sometimes with me, but more frequently detached, ... though to no great distance, and making by my directions, and chiefly with my excellent instruments [212, 457], those observations which it would have been my pride and pleasure to have made myself, but which the state of my sight and health prevented"[9] [196, 328–9, 346].

In June they paid another visit to the Chaur ; "There we were overtaken by a very severe storm, the approach of which was amongst the grandest spectacles I have witnessed. To be enveloped in the densest and blackest clouds, to see them flit across one with the rapidity of lightning, or rolling beneath our feet like the billows of a troubled ocean ; to hear, & I may say, to see, the tremendous gusts which are only to be heard or seen in these mountainous regions, all this had something in it equally new & astonishing. Our feelings, however, were not altogether of an agreeable cast, for the rain soon fell in torrents (literally), the darkness became excessive, and the cold was sufficiently severe when assisted by the sharp gusts of wind. ... After the storm was over, we proceeded towards the summit"[10].

They retired to Sabāthu for the rains, and in July Hodgson sent in his resn. ; "The injuries my health and sight have sustained render me incapable of further exertion. ... For more than a year past I have been disabled. ... A severe affection...of the nerves of my head and eyes has rendered me incapable of reading, writing, or bearing the light, without very great pain and increase of my disorder. ... I can truly say I have never avoided either difficulty or danger, ... nor...great extra expence in buying the most valuable instruments, of which I have a much larger collection than, I believe, any individual in India ever possessed"[11].

His resn. was accepted and, under BGO. 19–8–18, he was appd. "to command the escort of the Resident at the court of Mulhar Row Holkar" [457]. "In October 1818 I was obliged to...go to Calcutta in consequence of a dangerous disorder[12] [461]. ... On my recovery I went to Indore in Malwa, being employed on military duty and, after an absence of nearly two years, ... I again visited Seharanpur for the purpose of meeting Lieut. Herbert that we might jointly prepare this paper"[13] [38, 457].

His duties at Indore were "not very heavy", but he was involved in a long corr. with the SG. and the MAG. over his allces., not only for the 3 mo. with the Army but also for last six mo. on the svy. during which he had kept no regular fdbks. Mackenzie was particularly scornful because no map had resulted from all his labours ; "I wanted nothing but a sketch of the primary points on a reduced scale of 24 or 48 miles".

Hodgson had been struggling with his astr. obsns. on which he had relied, but owing to the mysterious, unsuspected, malign influence of local attraction [175–7], it was not until Herbert had measured a base-line on the ground that it was possible to adjust the compns., and obtain a fit basis for compilation of a map [2, 37, 196]. Hodgson writes, 12–12–19 ; "It is a subject of a very extended and complicated nature, and requires great leisure and much consideration. ... I think if leave of absence for some months were allowed to Lieutenant Herbert and myself to meet, ... the public service might be benefitted". Leave was granted, and Hodgson came up to Sahāranpur during the rains of 1820, and joined Herbert in revising the compns. and completing the compilation and drawing of the map, and report on the snow peaks [*sup.* 286, 356]. Then only was he able draw his allces. in full.

[1] Journal, IO Lib. (272). [2] cf. Fanny Parks, II. (78). [3] MRIO. 187 (27), 2″ svy. taken at Jaipur ; ib. 81 (55), map scale 16 m. to inch, shewing march to Jaipur. [4] Fdbk. MRIO. M 380. [5] Lord Moira [83 n.2]. [6] DDn. 157 (7), Feb. 1818. [7] from his batt. [457]. [8] DDn. 152 (38), 24–5–18. [9] DDn. 144 (157), 6–4–19. [10] MRIO. M 362, 4–6–18. [11] DDn. 152 (51), July 1818. [12] for a surgical operation [*inf.*]. [13] *As R.* XIV. 1822. (60–152).

Not only had his bills been refused for the period Nov. 1817 to Jan. 1818, but also for Feb. and March 1818 on the grounds that he was sitting at Karnāl. "But," he writes, "I arrived at Karnaul on the 19th February from Saharanpore, which is a primary and most important station in regards to the mountain triangulation. I was there assiduously employed at my observatory from the beginning of the month, watching to take advantage of every instant of favorable weather. ... I can call on...Mr. Grindall [175 n.3] and everyone who knows me to state if my whole time there, as elsewhere, was not employed in the cause of my duty, so that I was obliged to nearly neglect social intercourse [446]. ...

"Kurnaul is also a station of some consequence regarding the mountain operations. It was in my route to Nahan, and I arrived there on the 19th February to await Lieutenant Herbert's arrival from the army, and to arrange our intended separate operations. ... I was there attacked by lameness in my feet, and also the disorder in my head". After his journey to Nāhan, the Chaur, and Sabāthu, "he was exceedingly ill, and set out in bad health for Bussahir. At Simla I was found by Captain Ross [453 n.5], who took me back to Subathoo, where I arrived on the 10th June 1818. ... Though my case may not come under the strict regulations of the Surveying Department, it may indulgently be considered as a special one"[1] [347–8, 354–6].

On Mackenzie's death, 8–5–21, appd., 30–5–21, to succ. as SG., having taken over on 25th [193–4, 300, 351]. His appt. was not, however, endorsed by the Directors, and he had to hand over to Blacker in Oct. 1823 [301], not before he had accomplished a great deal of excellent admve. work, the most important of which was the start of rev. svys. in the Upper Provinces [7, 135, 149–51, 158, 213].

On Blacker's arrival he took office as Rev. SG., and moved hdqrs. to Fatehgarh [8, 151, 160, 181, 305–6, 333–4, 449], where he remained till, on Blacker's death, 4–3–26, he was again called down to succ. as SG. [3, 8, 57, 88–90, 130–1, 151, 190, 199, 203, 210, 222, 301, 310, 322, 482, 496].

His health was not good; he was "laid up by gout" 14–3–28 [456, 460], and he asked for furl. with permission to retain office of SG. till able to return, a request that was decisively refused. He writes, Barrackpore 6–12–28, a week after his wife's death; "I am an old officer, and have entered the 30th year of my actual service in India, and have been much and actively employed during the last 16 years as surveyor, as Surveyor General, and Revenue Surveyor General. ...

"I did hope, at some period, to return to England with my family, and there to pass the remainder of my days. But it has pleased God to frustrate these hopes, as you know, and I now solicit the permission...to return to England... on furlough for the re-establishment of my health. ... If my life should be spared, I think my presence in England may be productive of public advantage. ... On a suggestion of mine [275–6, 284–5, 294, 298] the Honorable Court was pleased to approve of a proposal for the construction of an atlas...on the scale of 4 miles to an inch. ... In 1823 I had begun on this work, and I sent home 15 sheets and a title page. ... The Government was pleased to recommend the engraving of this portion of the atlas at home, but I was soon after removed from my office. ...

"We have a large collection of valuable materials...now completed for transmission to England. The surveys still go on in parts less perfectly known. But the most important desideratum is to adopt proper measures for connecting these materials into one whole. ... I say...that it can only be done in the office of the Surveyor General of India, on the spot. ... There are, however, many points of detail...which I could fully explain with advantage in England, and many other matters which...I could place before the Honorable Court... more distinct than...by correspondence [287–8]. ...

"A large dispatch of valuable maps, with some copies of the Atlas sheets...is nearly ready, and...I propose to take them to England myself. ... I propose...to embark this or the early part of the following month"[2] [292–3].

His mc., 22–12–28, refers to—strenuous work in the mountains—"at night had only a very small mountain tent to sleep in"—a surgical operation in 1819 "to divide the scalp and pericranium down to the bone" which gave substantial relief—"In 1825 he suffered from several severe dyspeptic attacks, accompanied by most painful sick headaches. These complaints have been increasing in frequency and violence ever since, and during the latter part of last rains his sufferings were so great that he was incapacitated from transacting business, and were it not for peculiar family circumstances, I should at that time have recommended his proceeding to sea. Since his late severe family affliction his complaints have increased so much that I consider a voyage to Europe the only measure likely to restore his to health"[3].

Leave was granted, but he had great difficulty in obtaining a clearance cert. from the audit office, on account of discrepancies in the stock books [215]. He was also called on for a full report on the surveys of India and their future development [195]. Handing over to his trusted friend Herbert, he sailed 24–1–29. It was characteristic that he took on loan for use on the voyage, several astr. insts., which Everest brought back in 1830.

Returning to India 15–12–33, he was then employed on regtl. duty, but again took furl. on mc. 1835–40; Bde. Comdr. from 20–12–44; comdg. at Delhi 24–1–45, and in Rohilkhand from Jan. 1847; d. Ambāla, 28–3–48, whilst on mc. to Simla.

Hodgson had always been an enthuastic astronomer, and never missed an opportunity of taking obsns. [186–9, 447, 495]. Many of these were pub. in India or England, and he was a frequent corr. to scientific journals[4].

As R. XVII, 1833, part II (1–12) contains his paper *Observations on the Inclination and Declination of the Magnetic Needle,* followed by table of obsns. made at SGO. Calcutta Feb. 1828; declination only.

Another paper, Titaghar May 1840, describes his astr. obsns. at SGO. 1822–8, and those by the survrs. he had trained. He adds that during his first furl. "my opinion was demanded at East India House as to the best construction of theodolites...for the revenue surveys in North Western Provinces. I well knew the defects of the instruments already supplied, which were unsteady and top-heavy. I... consulted Mr. Simms [of Troughton & Simms], and we agreed on the construction of the instrument...described"[5].

In an ob. notice it is recorded that "On his return to Europe [1829] he resided for some time in the city of Durham, and in June 1842, in consideration of his distinguished character as a man of science, he was admitted to the honorary degree of M.A. in the University"[6].

His career is yet another instance of long service—nearly 29 years in India without a break, including 8 years as SG. and R SG.—followed after furl. by mil. commands till his death at the age of 71 exactly 48 y. after his first arrl.

HOLLAND, James. Bo. Inf.
b. 11–9–05. d. 16–4–89.

Ens. 4–1–23 ... Bt. Lt.-Col. 4–7–56; ret. as Hon. Col. 14–2–57.

Son of James Holland, purser, EIC., and Mary his wife. ed. Westminster. *OW.* I (471).

[1] DDn. 145 (53), 12–12–19. [2] BMC. 19–12–28 (151); cf. Markham (405). [3] DDn. 231 (202), 22–12–28. [4] *RAS* (*mn*), I, IV. [5] *JASB.* IX, 1840 (75–89). [6] *RAS.* (*mn*). IX. 1849 (59

m., Ahmedābād, 11-7-33, Jane Glegg, sister of Alex. Burnes [431]; one of their sons b. Ootacamund, 28-10-42.
1830, as DAQMG., with Burnes on exploration of Rājputāna [132-3]; later, QMG. Bo. Army.

HOME, Richard. Ben. Inf.
b. 17-3-1789. d. 19-4-62.

Ens. 1-1-04 ... M Gen. 28-11-54.
Son of Robert Home (1711-98), portrait painter, *DNB.* [I, pl. 9 n.] and Susannah Peterson his 1st wife; bro. to John Home, also Ben. Inf.
m., Lucknow, 4-10-22, Francis Sophia, dau. of Chas. Fraser, Ben. Inf., and sister-in-law of F. V. Raper [II, 438].
Hodson, II (474).
BTC. 16-3-30; compiled map of Jubbulpore Dist., for which he was granted Rs. 500 [87].

HORSBURGH, James. Hydrographer.
b. 23-9-1762. d. 14-5-36.

Appd. Hydrgr. to EIC. 10-11-10.
Of humble parents, of "village of Elie on SE. coast of Fife. FRS. 1806.
DNB.; *DIB.*; Markham (10, 404-5); *JRGS.*, VII, 1837 (vi); *Geo Mag.*, I, 1874 (133); Parkinson; *RAS* (*mn*)., IV (38).
Appce. on bd. North Sea colliers "commencing life as a cook and cabin boy"—taken prisoner by French, 1780—after release reached Calcutta via W. Indies—3rd mate, *Nancy*, a country ship—from 1788 on China trade on various ships—comdd. *Anna*, built Bombay 1790, making several rapid passages, once leaving Lizard 20-4-1802 anchored Bombay 31 July; reloading with cotton sailed again 25-8-02, reaching Canton R. 30th Sept.; discharged and reloaded and sailed 3rd Dec., anchored Bombay 11-1-03, discharging in 8 days—made various charts in eastern seas.
Returning to England 1805, pub. *Directions for Sailing... East Indies*, 1809-11, and "after many years indefatigable research" his *East India Directory*, 1808, for which the Directors awarded him 100 guineas; this ran to 9 edns. by 1874.
Paper on his meteorl. obsns. read before RS., and pub. *Phil. Trans.* 1830 (117-20) followed later by other papers.
In ch. map compilation at India Ho. from 1810; various svys. in India pubd. under his direction [74-6, 79, 232 n, 2, 285-6].

HYDE, John Fleming [II, 409]. Ben. Inf.
b. 28-9-1785. d. Calcutta, 12-5-46.

Ens. 3-8-07 ... Capt. 1-5-24; struck off, 11-3-46.
Son of Gertrude Dowling.
m., 15-2-13, Eliza, dau. of F. H. Pearson (d. 1800), Ben. Inf.; she d. Calcutta, 17-11-17, aged 22.
Hodson, II (519); III (802).
1813-4, survd. Calcutta suburbs [II, 18].
1814-21, Asst. to SG.; 14 mo. sick leave to New S. Wales, till 7-2-16 [425, 433, 487].
BGO. 2-12-17, leave to Benkulen, Sumatra [309], extended to 14-7-18 under BGO. 11-8-18.
From SG. to Gen. Dept., 16-2-21 & BGO. 1-3-21, granted 12-mo. leave to Europe, vacating post; ib. 4-3-25, permitted to return under CD. to B. 25-8-24, but struck off later as he had not returned by March 1826 [221-2, 310].
Later settled in Calcutta, and at one time Sec. to Lottery Com. [13].
Possibly musical, for Mackenzie writes to him, 8-11-19; "I suppose your musical people are entirely taken up by the Rival Harmonics, & that the peace of the good town is no longer disturbed by the vestry commotions & the liberty of the press"[1].
Worked happily with Mackenzie, though not altogether his ideal ASG. [309, 477-8]; Mackenzie congratulates him, 21-3-20, on rise of pay..."to 500 sonaut rupees per mensem. ... As I imagine you will feel some satisfaction, I hasten this at night, & wish you joy sincerely[2].

IRVINE, Archibald. Ben. Engrs.
b. 10-11-1797. d. 29-12-49, Highgate, Middlesex, after riding accident.

Ens. 6-5-17 ... Maj. 28-6-31; ret. 5-5-46.
Son of Thomas Irvine, farmer of Hawcleugh, co. Roxburgh.
m., Allahābād, 27-3-35, Marianne Eliza Sparks, dau. of J. T. Shakespear, BCS.
CB. 1831.
Hodson, II (528-9); Ursula Low (156); Creighton (32-40); Thackeray (35).
BGO. 5-8-15, detained in England for course on the Trig. Svy.; CD to B., 15-3-16; "Cadet Archibald Irvine has completed his course...and will be sent out this season".
Marātha War, 1817-8; MRIO. 81 (6, 40-2), survd. routes Saugor to Bhopāl, acknowledged by Malcolm [84]; Asst. Engr. 2nd Inf. Bde.
1821, Adjt. S & M. Allahābād; DDn. 198 (1), SG. recommends him, 1-3-22, for svy. of Narbada from source to *Hoshangābād*; "from what I have seen of his operations as a surveyor, and learnt from the officers of his own corps respecting his character and abilities, I...believe he would execute it very satisfactorily"; no record found of this svy.
BGO. 22-7-25, appd. offg. Suptg. Engr. sw. Frontier; Bde. Maj. at siege of Bharatpur, 10-12-25 till severely wounded 18-1-26.
DDn. 203 (41), 28-9-26 & MRIO. 160 (42) & Misc. 8-0-26, made "plan of River Jumna from Agra to Allahabad...for Committee of Embankments at Allahabad"; lithd. copies, *Ben Regr.* 234 (6, 7).
Ben Regr. 184 (90), Svy. of Allahābād Fort, with country 1,200 yds. round, scale 100 yds. to inch; James Prinsep completed the map finding "the paper very fragile and worn" [495]. Irvine had left the svy. incomplete on departure to Europe on mc., but lithd. copies dated 20-11-26.

JACKSON, James Nesbitt [II, 409]. Ben. Inf.
b. Calcutta, 16-8-1788. d. Calcutta, 8-6-32.

Ens. 27-4-05 ... Maj. 2-3-30.
Son of William Jackson, Registrar of Supreme Court, Calcutta, and Margaret his wife.
m., 1st., Cawnpore, 26-2-11, Augusta Katharine, dau. of Col. Wade, 25th Lt. Dragoons; she d. Calcutta 5-4-31.
m., 2nd., Calcutta, 10-4-32, Mary, sister of Malcolm Nicolson (1792-1850), Ben. Inf. (Hodson, III, 393-4).
CB. 27-9-31.
Hodson, II (538); III (729); Pankridge (47).
1814-5, on svy. of boundaries, Burdwān, Hooghly, and Midnapore [II, 19]—Nepāl War, on mil. service—completed svy. between April 1816 and July 1817 [12].
Jan. to May, 1819, survd. line for road Midnapore to Nāgpur [27-8, 88, 266 n.1, 348, 510], "a good route survey".
B *to* CD. (Rev.), 30-7-23 (235), to be Sec. to Com. of Control, Calcutta Canals [13].
BGO. 27-3-24, posted to Gen. Staff with expn. to Burma as DQMG., with rank of Maj. [335, 337, 507]; obsd. lat. of Rangoon [71, 183]; applied officially for services of competent survr., resulting in despatch

[1] DDn. 156 (171), from Palta. [2] ib. (174), 21-3-20.

of Grant [71, 455]. HMS. 665 (275), Burma Intelligence reports from Jackson, 5-1-25; lithd. map, MRIO. 3-O-26 [80].

1828, AQMG. at Presdcy.; DDn. 265 (208-17), 17-6-31, submitted, und., useful map of "part of Singhbhum, showing the country of the Kols, who had recently been troublesome", MRIO. 56 (11).

B to CD. (Pub.), 27-4-30, to be Supt. of Telegraphs in 1828 till post abolished 1830 [272]; HMS. 677 (485-9), 30-12-30 & 25-1-31, declined deputation to Arakan to select admve. capital and report on communications with Burma.

JACKSON, Philip. Ben. Art.
b. 24-9-02. d. 1879.

2/Lt. 11-4-19 ... Capt. 1-12-34; invd. 23-11-35; ret. 4-1-36.

Son of Capt. James Jackson, IN. and Harriot Goodchild, his wife.

Hodson, II (539).

18-12-24; Ex. Offr., Singapore; Survr. of public lands, from 27-5-26; in ch. Resdcy. 3-8-26.

MRIO. 90 (21-29) map of Siam, 1825 [80].

JERVIS, Thomas Best. Bo. Engrs.
b. 2-8-1796, Jaffnapatam, Ceylon. d. 3-4-57.

Ens. 1-6-13 ... Maj. 28-6-38; ret. 30-12-41.

Son of John Jervis, MCS., and Elizabeth, dau. of Capt. G. F. Ritso, RE.; bro. to G. R. Jervis (1794-1851), also Bo. Engrs. [II, 409].

m., Māhabaleshwar, 15-11-30, Anne Sarah, dau. of Dr. Wm. Paget, ret. surg. HM. 48th Ft.

Bio. under title *Thomas Best Jervis* by his son, W. P. Jervis, pub. London, 1898.

From Addiscombe, 1811-2, attended course with OS. at Worcester [209]; arrd. India May 1814.

Oct. 1819, appd. Ex. Engr. s. Konkan; Oct. 1820, to make statistical svy. for civil purposes [172-3].

BGO. 16-12-20, with expn. against pirates on Arabian coast of Persian Gulf [439 n.7], and survd. marches, Feb.-March 1821.

Bo RC. 25-1-23, appd. Asst. Survr. under Sutherland [126, 209]; continued svy. of s. Konkan till closed in 1830; measured his own base-lines [499]; trgd. a large area, combining his topo. svy. with statistical and rev. svy. for the civil admn.; results pub. 1834 as "The Konkun Atlas, ... accompanied by numerous illustrations of the scenery, natural history, & antiquities"[1] [5, 129-30, 220-1, 439].

Writing from Ahmednagar 12-4-31, Jervis had pressed for recognition of this work; "I have lately been so continually transferred, ... having within the last fourteen months been through every division and province of the whole Presidency of Bombay, excepting the Southern Mharatta Country and Khandesh, to the former of which places I am now ordered. ...

"Shortly after Mr. Elphinstone's accession to the Government of this Presidency in 1820, I applied to him personally to make a Statistical Survey in connection with a very improved Topographical and Trigonometrical Survey of the Concan. ... For want of either instruments, salary, or some settled allowance for writers and draughtsmen, which it was perfectly unreasonable to imagine I could furnish from my own limited pay, ... it proceeded with the greatest difficulty. ... I was directed...to prefer contingent bills [352]. ...

"The delays which occurred between the payment of my contingent bills, and the want of proper instruments, led me to explain. ... Mr. Elphinstone himself expressed his displeasure, and immediately issued an order for the discharge of all the expenses I had incurred. ... I made the Deputy Surveyor General...acquainted with all my past proceedings, and through him I handed up to Govt. the whole of my labours. ...

"The Statistical Survey had been considered a...distinct office of the civil department, ... its progress...approved of, ... and I was...to correspond on all matters relative thereto with the Secretary to Govt. ... Establishment was granted to me since 1824, and the last Governor, Sir John Malcolm, ... added thereto three Sub-Assistant Surveyors [392-3]. ...

"In May last, 1830, when...Sir John Malcolm directed the military survey of the Concan to be discontinued, and...Capt. Jopp required of me to deliver up every document, plan, and paper I possessed relating thereto in maps, books, official correspondence of whatever sort [126-7], and I am now left without the means of substantiating my claim, either to the remuneration pledged to me by Mr. Elphinstone, or to complete a most useful work.

"Designed...for the preparation of a minute and beautiful map (strictly drawn in the manner of the English survey), ... to accompany an Historical and Statistical Sketch of a large Province, ... to portray its geographical and characteristic features as a military defence, ... its resources and productions as an inlet to commercial enterprize. ... I hastily transcribed all I could, ... but after ten years labour can derive little satisfaction in bringing forward a work incomplete and inaccurate. ... I therefore most earnestly solicit that...I may be furnished with my own original surveys, and the trigonometrical survey also, ... that I may prepare from them authentic, correct, and perfect, copies. ...

"The copy of the report on Weights and Measures I enlarged and greatly improved, and the Government... generously paid the expense of printing...300 copies, which cost 1,598 Rs., and gave me back 100 copies to distribute to whom I pleased. I have received the sanction...to print all my maps, drawings, plans, and memoirs, but I find myself perfectly unequal to the undertaking without the aid of Government"[2].

He closed by pressing that his salary for the whole period of the svy. should be placed on a higher basis and on this the Bo. Govt. promised him an extra allce. of Rs. 200 pm. from 15-2-26 to 31-5-30 as soon as he delivered in a fair copy of his memoirs and maps. This he did in 1836.

A further claim was met by the Directors on his return to England on furl. in 1837, when he gave such a good account of himself that he was appd. "provisional" SG., in the event of Everest's resn., which, however, did not occur till after Jervis had himself resd. [506].

A call for his original maps led to their close scrutiny by Everest, who declared them unfit for the Atlas of India, owing to the poor character of the trgn. [126-7, 203 n.2, 209-10, 344].

Jervis's greatest claim to prof. recognition is his success in printing maps by lithography, and long after his retirement he did noble service in reproducing Russian maps for use in the Crimean War and in founding the Topo. and Statistical Depot of the War Dept., which later developed into the Intelligence Branch and the present Geographical Section of the General Staff[3] [168, 299].

JOHNSON, Alfred Ford. Bo. Inf.
b. 10-4-03. d. 18-5-78.

Lieut. 4-5-20 ... Capt. 8-9-32; ret. 30-4-40; Hon. Maj. 28-11-54.

Son of Henry Johnson, asst. warehouse keeper, EI. Ho. and Francis his wife.

Bo GO. 7-8-23, to act as Asst. on Gujarāt rev. svy.

[1] IO Cat [439-40]. [2] Bo RC. 39/366/1831 (113-25). [3] Close; Frith.

JOHNSON, John [I, 341 ; II, 409–10]
Bo. Engrs. d. 11-2-46.

Ens. 31-5-1785 ... Bt Lt Col. 4-6-14 ; ret. 15-8-19.
m., Diderica Memeling, probably Dutch.
CB. 4-6-15. *EIMC.* I (220).

From 1790, svys. in Deccan & Malabār [I, 128, 130–1 ; III, 113]. 1800, at Goa [II, 96–7] ; 1803–5, Marātha War ; distinguished himself as Fd. Engr. & Survr., and produced map of Deccan [II, 165–7 ; III, 280].

1805–8, in ch. of timber extraction in Kanara [II, 409–10] ; 1808–13, furl. ; 1813, Supt. Engr., Bombay ; 1815, DQMG. with East's force on Cutch border [123].

Bo GO. 26–3–16, "ordered...to the Presidency, to assume charge of his appointment of Quarter Master General of the Army". April 1816, to Poona, and deputed to svy. passes along the Ghāts on the N. and W. borders of Khāndesh, and report on defence against *pindāri* raids [83–4, 122, 483].

Furl. from 1817, travelling to England via Persia, Georgia, Russia, and Prussia ; pub. *A Journey from India to England...* with 9 plain and 5 coloured plates ; 4to. ; 1818 [289].

JOHNSTONE, James. Ben. Inf.
b. 23-2-1789. d. 27-6-52.

Ens. 30-7-07 ... Maj. 15-12-35 ; ret. 23-5-36.
Son of Wynne Johnstone of Hawkslaw.
Hodson, II (562) ; IV (636).

Marātha war, 1817–8 ; svys. in Mālwa acknowledged by Malcolm [84], and from early 1819 on svy. of Bhopāl, under PA., whose escort he comdd. ; under technical instrns. of SG. till 1823 [87–8, 180, 202, 336].

1825–8, comdg. Bhopāl Contt.

JONES, John. Ben. Inf.
b. 18-3-01. d. 7-4-75.

Ens. 16-8-19 ... Capt. 20-4-26 ; resd. 1-3-35.
Son of John Jones of 63 Harley St., London.
m., Cheltenham, 1-8-31, Mary widow of Richd. Carpenter.
FRAS. 8-5-35. Hodson, II (565) ; Bhuyan (538 etc.).

1824–6, Burmese War ; on svy. in Assam on QMG.'s staff [53–4] ; BMC. 25-10-16 ; appd. offg. DAQMG. "to survey the positions of Bullepora[1] and Guro Sachee, for...settling the...North East Frontier, and also to survey the country inland between Bishnauth and Rungpore, both on the north and south banks of the Burrompooter"[2] [63–4].

His svys. frequently mentioned by Wilcox ; Nov. 1826, ref "Boree Dihing. ... A survey of this route has already been made by Lieut. Jones of the QMG.'s Department, but I believe not as accurately as it might be ; that officer having been hurried on his march by the charge of all the public cattle"[3].

DDn. 124 (63), 28-8-27 ; "Lieut. Jones...has surveyed from Chor Dewar to the Soobunsheeree, across the Mirjholee, to Rungpore. Thence to the *southern bund road boundary*, and along it westward, ... and returns by the river to Bishnauth, making a handsome circle. He is also clever (a pupil of mine !)".

DDn. 224 (83) ; " Lieut. Jones is about to execute... the survey between Gowahutty and Sylhet by this road, and, as it will be well done, I shall not of course follow him"— over the Khāsi Hills, Gauhāti-Moplong, Cherrapunji-Sylhet —with another through Jaintia—MRIO. 37 (24), Jan. 1828. Nov. 1828, at Nongkhlao[4].

Wilcox had been up the road as far as Nongkhlao ; "I have perused Captain Jones' remarks on this route across the Cosseya Hills. ... Lieut. Burlton who was employed during last cold season on the route from Raha Chokey to Jynteea, received instructions to amend the mountain paths, ... and particularly to supply substantial bridges where required [431]. Capt. Jones remarks that if further improvement is necessary, it is chiefly in blasting & removing rocks at the principal ghats"[5].

DDn. 265 (214) ; Jones' "map of central Assam, ... good geographical material", was incorporated in Wilcox's map [64, 299].

JOPP, John. Bo. Engrs.
b. 9-7-1792, Kingston, Jamaica.
d. 17-6-61.

Ens. 8-6-11 ... Maj. 26-3-35 ; ret. 28-10-42 ; Lt Col. 28-11-54.
Nephew of Keith Jopp, of Keith Hall & Joppa, Jamaica.
ed. Addiscombe.
m., Poona, 10-12-31, Eliza Jemima, dau. of Thos. Morris of HM. Customs, London.

Bo GO. 5-1-14, appd. to Rev. Svy. Salsette I., from 1-1-14 ; Bo MC. 24-9-14, warned for fd. service, probably in Gujarāt.

BGO. 4-4-16 & 19-6-16, on svy. of passes into Deccan and on Cutch border under Johnson [122–3], and continued on svy. under Sutherland [125] ; 1818, in ch. trgn. of Deccan Svy. [5, 129, 454] ; Bo MC. (camp) No. 59 of 1822, reports, Poona, 7-6-22, that Jopp had taken over ch. of Deccan Svy. from Sutherland [125–6, 323, 344, 352, 393].

Bo MC. 22-2-26 (78), appd. DSG. Bombay [6, 126, 128–30, 212, 281, 323, 344, 463, 473], holding post till abolished 1-9-33.

HMS. 734 (596), 6-2-29, recdd. by Malcolm to succeed Hodgson as SG. of India [301].

KEYS, William. Bo. Inf.
b. Bombay *c.* July 1801.
d. 24-5-39, Dapoli, 18 m. S. of Bankot.

Lieut. 25-12-17 ... Capt. 25-3-29 ; invd. 31-7-37.
Probably son of Charles Keys, Lieut. Bo. Mar., and, Elizabeth Warner his wife.
Bo GO. 1-11-20, appd. asst. Rev. Survr., Gujarāt ; on rev. svy. Kaira Dist. till 1824 [170 n.5].

LAKSHMAIAH (or LECHMYAH), Kavali Venkata, Brahman. Mad. Translator.

Appd. Interpreter, May 1798 ; succ. as hd. intpr. 7-1-03, on salary 40 *ps.* pm. [II, 355–7, 469 ; III, 391–2].

Son of Kavali Venkata Subbiah, and younger bro. of Kavali Venkata Boriah [II, 383–4] ; bro. to K. (C.) V. Ramaswamy [391 n.2][6]. Said to be one of the three Madrasi

[1] Hence the Balipara Frontier Tract of later days. [2] DDn. 217 (15) ; *As R.* XVII (358–9). [3] DDn. 224. [4] *As R.* XVII (503 et seq) ; facing p. 512, sketch of Bhuban Cave, Sylhet, by Jones, 1827. [5] DDn. 224 (105–10), 15-10-28. [6] Auth. of *Map of Ancient...Dekhan*, Calcutta, 1827, 20 *cos* to inch.

figures, probably the central one, shown in Hickey's portrait of Mackenzie [II, pl. 22 n; III, 474 n.1].

1798 joined Mackenzie at Hyderābād, and accd. him to Mysore [I, 350–1]. On succg. Boriah as hd. intpr. took leading part in collg. historical inscriptions and mss.[1].

1811–5, during Mackenzie's absence got into serious debt, which culminated in 1817 with arrest and imprisonment, to Mackenzie's great distress [II, 356–7].

May 1818, joined Mackenzie in Calcutta, having marched up E. Coast with others whose religious prejudices forbad journey by sea [481].

There was great delay in getting the party off because of Lakshmaiah's private affairs. He was anxious to obtain delivery of a grant of land which Mackenzie had obtained for him, and he was then held up by a court summons instigated by a personal enemy. Riddell writes, 24–9–17; "Letchmyah is not yet off & appears determined not to move till his Grant is settled. I have in vain told him that he does no good here. ... I have merely got him to promise to send off the others immediately & himself to overtake them. ... The delay is, therefore, entirely his own, and after all your kindness it is rather selfish". Oct.; "Letchmyah has at last gone; his department started some time before him, but as he travels in a palanquin he will overtake them e'er they arrive at Masulipatam".

Riddell then heard that he was in gaol, having been arrested for a debt of 5,000 *ps.*; "Instead of going off on the 15th he had gone to Tinnanore, his village, and remained there till the 30th. He came to Madras on the morning of that day & was setting off in reality, when he was seized by the Bailiff. ... He is now at large, having given security that he will not leave Madras. ... He says the debt is falsely sworn against him". 6–12–17; "After much trouble I got Letchmyah off this morning, ... leaving the title deeds of his property in the hands of...his bail". His case was eventually "settled against him, to tune of 4,000 *ps.* instead of 6,300 as claimed"[2].

Supervised trn. and arranging of collns. in Calcutta till Mackenzie's death in 1821, after which assisted Dr. Wilson in preparing catalogue [392, 482].

Received substantial legacy by Mackenzie's will, and granted pension on full salary, with other concessions, on his rett. to Madras [479].

After return to Madras, and on advice of Sir Alex. Johnston [480 n.1], founded, and became Presdt. of, a "Literary Society of Hindus", whose object was to prepare "translations and digests of the mass of MSS. collected by Colonel Mackenzie, at the same time that other materials of a similar nature might be sought out and accumulated".

In 1830, at Lakshmaiah's request, the colln. was placed at disposal of the Mad. Lit. Soc., and a few articles pub. in the *Madras Journal of Literature and Science*. He writes on 16–6–35, as "corresponding member of the Royal Asiatic Society of Great Britain", that he was "still engaged in classifying the different dynasties, ancient and modern, of South India", and asked the Madras Govt. for authority to pursue the researches started by Mackenzie, with pay for 2 scholars in every district, and free postage.

This was referred to ASB., who did not consider him qualified for such comn., but recdd. the empt. of the Rev. Wm. Taylor to report on those mss. already stored at Madras [482][3].

LAMBTON, William [II, 411–5]. HM. 33rd Foot.

b. Crosby Grange, Yorks, 1753/6.
d., 20–1–23, Hinganghāt, CP., MI.

Ens. 6–5–1782 ... Bt. Lt Col 4–6–14; STS. 1818–23.

His sister, Dorothy, m. Thos. Lye, of Yorks., and d. Feb. 1827, leaving husband and 2nd son, Wm. Lambton Lye, still living.

Left 2 nat. children, William and Eliza [469–73].

Corr. Member, Institut de France; FRS. 9–1–17 [468].

DNB.; *DIB.*; *RMC.* V (36–9); *EIMC.* III (100) Warren; Ingledew; *A&N. Mag.* XI (165); Markham (60–72); *Statesman*, Calcutta 13–1–1923.

Portrait in oils by Wm. Havell, Hyderābād, 1822, presented in 1828 to R As Soc., London, by Sir Wm. Rumbold[4] of Wm. Palmer & Co., Hyderābād [493 n.6, pl. 22]. Miniature of same period with S of I. [438, 467].

1782, joined 33rd in New York; 1783–96, ex-regt. empt. Nova Scotia & New Brunswick — Bkmr. from 1785 — rejoined regt. in Calcutta 1797 and with it to Madras, Sept. 1799, on appt. as bde. maj. to King's troops under Ft. St. George — bde. maj. 1st. Bde. at capture of Seringapatam, 4–5–1799 — with Grand Army, w. Mysore, Aug–Nov. 1799 [II, 412–3].

His proposal for trig. svy. on scientific principles was sanctioned 6–2–1800—Preliminary svy. Mysore, 1800–2—Base-line St. Thomas' Mount, April 1802—Meast. of degree along Coromandel Coast, 1802–3—Triangles E. to W. from coast to coast, and start of central arc, 1803–6—Triangles down S. coast, to Tanjore, 1806–7—Central arc to Cape Comorin, with general svy. and map of S. peninsula, 1807–10—Extended central arc through Ceded Dists. into Hyderābād, with connection to E. coast at Guntūr, 1811–5 [II, 233–49]. In his *Notices of Malabar*, tells of riding on horseback up the Gazalhatti Pass from Coimbatore in 1806 [I, pl. 9; II, 414].

Feb. 1815, having measd. base at Bīdar he brought hdqrs. to Hyderābād, and maintained them there till end of 1822 [II, 249; III, 223, 237].

Up till 1806 had asstce. of 2 officers of King's Regts., and from 1807 several officers from MMI. [II, 322–3], but from 1812 was left with 4 sub-assts. ed. at obsy. survg. school [II, 346; III, 223, 378–9, 439].

1812, specially retained in the Company's employ in India after departure of 33rd, being granted bt. rank as Lt Col. with special allces. [II, 415].

Worked under direct orders of Madras Govt., and in no way under SG., though submitting regular reports [307–8]. His relations with Mackenzie had been cordial from the start, and wherever possible all dist. and topo. svys. were based on his triangles [II, 115–21; III, 4, 94, 101, 106].

He writes to Mackenzie, 9–1–16; "When do you set off for Bengal, and who has charge of your office at Madras? I think it likely that I shall take another peep at Bengal before I visit England [99, 223, 476], for I propose taking a look at the Circars before I commence my operations, and shall probably go as far as Point Palmyras [II, 249; III, 233]. I am here comfortably settled at the French Gardens [251 n.3, 437 n.7], ... my place of business and study. I have, besides, a house in the Cantonment when I want recreation and amusement. I have met with such liberal support from Mr. Russell that not one difficulty has occurred since I entered the country [II, 372; III, 116, 412]"[5].

Mackenzie replied with equal cordiality, telling of his own interests; "No man could have acted for another with more precision & friendly attention than Colonel Morison in my long protracted absence [II, 299], & Lieut. Ward, who resided in the different houses to which my effects were

[1] Translations of mss., MRIO. M 125. [2] DDn. 151 (25–83, 169). [3] *JASB.* V, 1835 (436, 511–3) (1788–1833). [4] 3rd Bart.; g. son. of Sir Thos. R., Govr. Madras 1777–80 [I, 241, 322]; d. Hyderābād 24–8–33. [5] DDn. 62 (183).

repeatedly transferred in my absence, appears to have paid the utmost attention [II, 303-4]. I see...that all your books, plates, & most of your things were delivered to your order. ...

"If you are once in the Circars, you can easily visit Bengal, especially during the cessation of the rainy months. I wish with all my heart that I may have the pleasure of seeing you while I am there. I remember your house of the French Gardens well & think you are lucky in having such a place"[1] [437, 472].

Lambton had often referred to a possible visit home, and Riddell writes that "in 1812, before I left him, he frequently talked to me of his intention to go home for a year or two, and of my taking charge of the survey during his absence. He even went so far as to enter on the subject of allowances"[2].

He writes to Russell, 21-5-18; "Should I not be able to proceed further [than Ellichpur], I shall prepare the way for my successor. The great length of time which has attended my labours must naturally induce me to look towards England, which I hope to see in a very few years, and where...I can be of...use in superintending...such maps as the...Directors may think proper to publish"[3].

He remained at Hyderābād for the next two years working on compns. and reports, sending his assts. to extend trgn. [8, 223, 227, 437-8]. He writes again to Mackenzie, 28-7-17;[4] "I...was glad to hear that you had got all settled at Madras. As you will be in Bengal soon I have directed to you there [475-6].

"I am nearly putting the finishing hand to the 3rd copy of my report, one copy for myself, one for Government, and the 3rd for you [237]. ... It consists of upwards of 600...pages, and one copy takes upwards of three months to make out, with the plan annexed to it, so that there has been upwards of nine months employed in mere copying. It is, however, a valuable work, as I had better data to go on than I had before. I have computed every position in the whole peninsula [II, 264]. ... You must, however, have the first vols. in your office, and it shall be copied as soon as I have time. ... Your being in want of data in the Circars makes me very anxious to get the operations carried through them [5, 99, 223]. ...

"I am now about to send out a party to continue my meridional triangles up to the Godavery, and then run east and return upon Hyderabad [223], which, with what you already have, will form a tolerable basis for a survey of the southern parts of the Nizam's Dominions [114].

"I intend constructing an entire map of the Peninsula from my own materials which of course you will get a copy of some day or other, but it will be a work of time. ... There is a blank in my work from Tellicherry to Callicut, owing to the setting in of the monsoon [II, 244-5]. ...

"If these warlike preparations prove successful there will be a prodigious field open for me, but if I am not allowed to move on a large scale I shall content myself with carrying my meridian arc as high as 26°. ...

"I received yesterday my diploma from the Royal Society on having been elected a member, and it was accompanied by a very handsome letter from Mr. Davis [I, 332], one of the Court of Directors. I have been extremely gratified lately by the attention paid me by that Society, and by the members of the Academy of Sciences at Paris, particularly La Place and De Lambre [177, 238, 468]. ...

"Let me hear from you on your arrival".

It was about this time that Lambton conveyed to the GG. his wish for a suitable asst., and a geologist, to be attached to the svy. Prompt action was taken by Lord Moira by the nomination of George Everest [1, 225, 446]. Lambton was now over 60 years of age, and, after a worthy tribute to his high qualifications and the great importance of his work, the GG. noted that "Lieutenant Colonel Lambton has himself urged this point to the Surveyor General, and has pressed on His Lordship the propriety of giving him an associate"[5] [441-2, 450]; Dr. Voysey was appd. later.

Lambton's svy. was now tr. from Madras to the control of the Supreme Govt. at Ft. William, a change that had been due since its extension into the Nizām's Territories. This change, with the new designation The Great Trigonometrical Survey of India, dated from 1-1-18 [1, 225].

On Everest's arrival at the end of 1818 Lambton took him out on a demonstration trip, and then left him in ch. to carry on field work [227-8, 442], whilst he himself visited Calcutta to make contact with the Supreme Govt., and to settle private affairs with his agents, Messrs. Hogue, Davidson & Robertson. He left Hyderābād in June 1819, and went by sea from Masulipatam. Mackenzie greeted him warmly; "Colonel Lambton is expected here, having applied for leave"—"I have seen Colonel Lambton when in town lately; I was surprised to find him quite grey haired"—Colonel Lambton is here [Palta] with me since yesterday; I think his health much lower than when I saw him in 1811, but we are all getting older"[6].

Amongst matters which he tried to get settled at Calcutta were—increased pay and allces. for his sub-assts. on tr. from Madras—increase of his regular escort, and their allcés. [379, 406]—and arrangements for passing of contt. bills. His last letter from Calcutta appears to have been that of 12-1-20, and he was back in Hyderābād by April.

In July 1821 he resumed the N. ward extension of his great arc. Deputing his sub-assts. to observe the triangles, he and Voysey marched direct to Ellichpur, some 360 m. from Hyderābād, in Feb. 1822 [8, 232, 438]. Everest rejoined from leave on 6th Feb., and was horrified at the deterioration of his health and the extent to which exertions in the field had taxed his strength; "men cannot last for ever; the Lieut. Col.'s infirmities had evidently subdued all but his spirit" [232-3, 443][7].

Back at Hyderābād the grand old man submitted optimistic reports as to the work completed and future plans. He did his last work on his prof. reports, and records the joy he took in his labour; "It is now upwards of twenty years since I commenced it on this great scale. These years...have been devoted with unremitted zeal to the cause of science, and, if the learned world be satisfied that I have been successful in promoting its interests, THAT will constitute my greatest reward.

"In this long period of time...I have scarcely experienced a heavy hour; such is the case when the human mind is absorbed in pursuits that call its powers into action. A man so engaged, his time passes on insensibly; and if his efforts are successful his reward is great, and a retrospect of his labours will afford him an endless gratification. If such should be my lot, I shall close my career with heartfelt satisfaction, and look back with unceasing delight on the years I have passed in India"[8].

[1] DDn. 156 (35-7), 3-5-16. [2] to Mackenzie, 26-11-17, DDn. 151 (77-82). [3] DDn. 92 (43-6), [4] DDn. 62 (142).
[5] Lambton's letter not found; BMC. 25-10-17 (148). [6] to Mountford; 4-7-10 & 31-11-1819; DDn. 149 (93, 105).
[7] Everest (3). [8] TS. V: enclosure 6; quoted by Thos. Jervis, (15).

At the end of 1822, after deputing Everest to run an independent chain of triangles towards Bombay, and Voysey to explore the country south from Agra to Nāgpur [265], Lambton packed the whole of his equipment and household goods to move hdqrs. from Hyderābād to Nāgpur, and though far from well set out on this march of nearly 400 miles. It was too much for him and, writes Everest, "he died on the 20th January 1823, at Hinghan G'hat, within fifty miles of Nagpore [8, 236, 438, pl. 18]. ... Mr. Voysey had been detached...in the previous month of October. ... His absence was a sad disaster, for he knew the Lieutenant Colonel's constitution well, and his manners were so fascinating and agreeable as almost to charm away sickness.

"But the Lieutenant-Colonel's health was in so precarious a state when he quitted Hyderabad...that it was thought hazardous for him to venture on so long a journey without a medical attendant, and accordingly the Assistant-Surgeon *first for duty* was nominated. The gentleman so draughted was a Mr. Morton...and, before they had been many days on the march together, he...twice bled his aged patient rather copiously, and adopted the antiphlogistic system of abstinence from wine and meat—the abundant use of oranges, &c.—a mode of treatment...diametrically opposite to that hitherto so successfully pursued by his medical adviser, and at variance with those established habits which had...become so thoroughly interwoven with his constitution that Mr. Voysey never contemplated...altering them [409–10]. ...

"The vigorous understanding of the Lieutenant-Colonel seemed to have sunk beneath the accumulated pressure of old age and infirmities, and he, whose manly mind knew not what superstition was, used...in the last two months...to tremble with horror at his dreams. So tranquilly and calmly did he breath his last that no one was aware of his death until, surprised at the unwonted profoundness of his sleep and the lateness of the hour, his servant entered his tent and found him a corpse.

"I had hoped to have been able to give to the world some biographical account of so singular a person; but the little historical detail which was found at his death in his own handwriting amongst his papers was tenaciously kept from my sight by Mr. Morton, ... and whether those into whose hands it fell will ever indulge us with a publication of so interesting a nature is highly problematical [443–4, 469].

"His death took place at the age of sixty-seven[1], and on dissection it appeared that the right lobe of the lungs was nearly consumed, and the left slightly injured"[2].

Other details may be taken from a report sent by Dr. Morton on 13th Jan.; "Colonel Lambton...has almost ever since we left Bolarum been very unwell. On the night of the 23rd December last he was seized with violent paroxysms of coughing, and great difficulty in respirations. ... On the night of the 28th the above symptoms again recurred to a very alarming extent. ... I accordingly took from him 16 ozs. of blood, which...afforded great relief. ... I...put him upon the antiphlogistic [diet ?] which he did not much like and, in fact, it was with great difficulty that I could keep him from drinking wine. ... He was...in every respect improving; so much so that on the evening of the 7th...he would not go without his wine any longer, feeling himself so much better that he...drank a pint, which sent him instantly to sleep when he went to bed; but when he awoke towards morning he...was quite upset. ... Since that night he has been far from well—cannot sleep at night—cough at times very troublesome—...no appetite...—very irritable...—and only answers YES or NO to questions put—...in short in my humble opinion, his days seem to be drawing fast towards a close. ...

"I sincerely wish we were at Nagpore, but we are obliged to go very short marches, so will not be able to reach it before the end of the month. ... P.S. You will perceive...that the Colonel is in a very precarious state"[3].

He was buried at Hinganghāt, and a worthy monument erected by the Resdt. at Govt. expense. Everest and Voysey had first intended to do this themselves[4], but in reporting his death Everest suggested that Govt. should erect an official memorial; "The death of such a man ...is an occurrence of no ordinary nature in India. He was a first-rate mathematician, and as such was in correspondence with many very celebrated Philosophers in Europe; amongst whom are Messrs. Delambre, La Place, and others in France, and Captain Kater, Mr. F. Fallows, Dr. Young, and others in England. He was a corresponding member of the French Institute, and a Fellow of the Royal Society.

"As his death...will excite a vast feeling of interest in Europe, ... I may be excused for suggesting the propriety, not only of accompanying the notification of his death with some considerable demonstration of respect on the part of Government, but of building at Hinghan Ghat some small but lasting monument at the public expense"[5].

The original tablet being lost was replaced in 1896[6] by deptl. subscription, and the DC. Wardha Dist. reported, 24–3–1925, that "Dilawar Khan, who had been looking after the grave, had just gone on pension. He had tended the flowers quite on his own initiative, recognizing that this must have been the grave of one of the "great Sahibs of the old days" [I, 40 n.1]. He was sent a copy of Lambton's portrait. In 1929, a new Christian cemetery was set out round Lambton's grave[7].

The portrait [pl. 22] is taken from that held by the R As Soc. in London and "painted 1822 at Hyderabad for G. Lamb Esq., by W. Havell"[8], being a life-size head and shoulders, on canvas 30 by 25 inches. A miniature—sufficiently like to have been painted at the same time—was purchased in 1901 by the SG. from Messrs. De Penning & De Penning, of Calcutta, for Rs. 300. Joshua De Penning had bought it at the sale at Nāgpur [469]. It is an oil painting on copper and after purchase was renovated in London[9].

Appreciations of Lambton's prof. work have already been quoted [II, 264–7; III, 10, 195, 239]. Of his personal life and character we are indebted to accounts by his assts. Warren and Everest. Warren, who had known him since 1798, tells us that his "stature was above the common size; his complexion was fair, and his hair tending to red. His face wanted expression, and the old accident [II, 412] gave a cast to his eye. ... He was never married, though his friends appear to think that his wishes sometimes pointed that way latterly.

"To a considerable portion of general knowledge, and a respectable share of erudition, he united much simplicity of character, so much so as to give many people a very inadequate idea of his powers of mind and knowledge of the world. Some peculiarity of manner too adhered to him from having lived so long out of the world, and he is said in consequence to have appeared to disadvantage in mixed companies, and particularly in the company of women. But to those who could, through this singularity, discern merit, his conversion was found alike entertaining and instructive. He had strong prejudices, yet no man was more quick in discovering talent, or ready in acknowledging it. ...

[1] presuming birth between Jan. 1855 and 1856 [II, 411]. [2] Geo. Everest (30–2). [3] DDn. 91 (231–4). [4] Geo. Everest (35); Warren (135). [5] DDn. 172 (10); 8–2–23. [6] the original tablet wrongly described Lambton as "First SG. of India"; this was now corrected by a second tablet. [7] from DC., 21–9–1929; SGO. file No. 111, 1925–6, 1934. [8] Geo. Lamb, Ben. Med.; partner in Wm. Palmer & Co.; Resdcy. Surg. Hyderābād from 1821; Wm. Havell visited India 1817–25 [510 n.7]. [9] SGO. file 21 of 1901–2; *S of IGR.* 1901–2 (9).

"He was of a quick and hasty temper, ... yet in reality most kind and considerate. His servants were affectionately attached to him, and grew old in his service; and of his public followers, he counted...three generations in his camp. The young men attached to the survey as sub-assistants he treated with uniform kindness, and with much consideration; and in return they looked up to him as a father [396–7].

"He read the Latin, French, and Italian authors, at least those who treated on science, with the same fluency as those of his own language. He was not, however, a good classical scholar, nor had he much taste for the fine arts, or even literature. His official style was neither eloquent nor yet lucid. He expressed himself with plainness, but not always with clearness. ... His private correspondence bore marks of haste...and he seldom attempted to correct a letter"[1].

Everest, who did not meet Lambton before Dec. 1818 [442], writes that he was "about six feet high, erect, well-formed, bony and muscular. His head was nearly bald, and the few straggling hairs which remained were thoroughly bleached by age and exertion. He was a fair-complexioned man with blue eyes, which time had dimmed and weakened. ... When he aroused himself, ... his high and ample forehead gave animation and dignity to a countenance beaming with intellect and manly beauty.

"I shall never forget the impression which the bearing of this veteran and far-famed geodesist made on my mind when I first saw him in the year 1818 [227]. ... For, though we had been in camp together for some days previous, he hed displayed no symptoms of more than common powers, but seemed a tranquil and good-humoured person, very fond of his joke, a great admirer of the fair sex, partial to singing glees and duets, and everything in short that tends to produce harmony and make life pass agreeably.

"These moments of activity were, however, like the last flickerings of an expiring lamp. It was evident that he was gradually wearing away under the corroding influence of a complaint in the lungs, attended with a most violent cough which at times used to shake his whole frame as if to bursting; and...the slightest exertion...was always succeeded by a violent paroxysm of his disorder"[2].

"At the time of my joining...at Hyderabad in 1818, he gave to both Mr. Voysey and myself a general invitation to his house; we were his constant guests, and formed part of his family; ... we constituted his domestic circle, and were of the very few with whom he discoursed familiarly and without restraint"[3].

Everest has left the following account of Lambton's recognition by the Institute of France. At the time of Warren's visit to Paris at the end of 1815 [II, 452], "his acquaintance was eagerly courted by the learned men of the day, particularly the late M. De Lambre, who was familiar with the geodetical operations of India, and the names of Lambton and himself, ... and many were the questions which he put regarding the man who had contended so well, so ably, and so long, with the difficulties of a foreign land and an alien people. ...

"In the course of the conversation...M. De Lambre... asked whether Lieut. Col. Lambton would like to be a Corresponding Member of the Institute and, ... being assured that he would certainly consider it as a very high and gratifying compliment, the diploma was forthwith made out by unanimous consent and, under cover of a very flattering letter from M. De Lambre [238], was sent to India where it reached the Lieut. Col. not very long prior to my joining him at Hyderabad in 1818.

"Shortly after this affair at Paris, Capt. Warren went to London and...the whole story soon got into circulation. ... 'The Royal Society...followed in the train of the Institute, and elected the great man a Fellow"[4].

Sir Sidney Burrard relates that at a luncheon of the International Geodetic Union at Potsdam in 1901 the Chairman, Professor Helmert, spoke warmly of Lambton's devotion to his great task, and of its great importance to geodesy. There was a courteous exchange of compliments between the SG. and the Institute of France at the centenary of Lambton's death[5].

In later years Everest had occasion to complain of an officer withdrawing from the field before completing his programme, and told Govt. that "the late Colonel Lambton, ...would never have quitted the field until the work was accomplished, for to return without would have broken his heart. But he was a very rare person"[6].

An account of Lambton's family and the provision he made for them is given under the story of his son William Lambton, jr. [469–73] and an account is now given of the unfortunate manner in which the sale of his property was effected [236, 438, 443–4].

Sale of Lambton's Property

On Lambton's death, full ch. of the camp was taken by Dr. Morton, who had only been attd. for med. charge on the journey from Hyderābād. He was an Asst. Surg. on the Madras Est., and as such a man of education and some social status. He won Lambton's confidence to the extent that his patient appd. him executor under a will that he sd. on the day of his death, witnessed by Morton and De Penning. The will is full and clear, and shows no signs of weakness of intellect [470]; it had probably been prepared some time before, for it deals with domestic matters in some detail.

De Penning was the senior member of the survey staff present, and was close on 40 years of age; he showed little initiative in this crisis, and surrendered ch. to Morton, allowing him to carry through his high-handed disposal of Lambton's effects with little interference. He writes to Everest, in evident distress, appealing for orders;

21-1-23, "It is with the deepest concern I have to announce to you the death of Lt. Col. W. Lambton which took place last night. ... As we are to proceed...under the charge of Mr. Asst. Surgeon J. Morton, we beg to be favoured with your instructions as early as possible. ... We expect to reach Nagpur on the 26th inst. and...we trust you will lose no time in taking charge.

He wrote again three days later, warning Everest of the immediate sale that Morton proposed [438, 443], but Everest was near Sholāpur, more than 400 miles away, and could do little to help. He wrote to Morton, 6-2-23; asking that the sale might be postponed "until the orders of Government are received. ... Mathematical instruments...will perhaps be purchased by Government, and if the sale be hastened before instructions are received it will be a very serious injury to the estate".

To De Penning he replied; "I have written to Mr. Morton by this day's post. ... He will, I doubt not, comply with my wishes but, if he does not, ... wait on him on my part, and enter a protest against the hastiness of the procedure. ... Had Lord Hastings remained in India, I should...have set out for Nagpore; but there is a new Governor General[7], who may not...attend to my pretensions. In that case I shall have to go to England, or perhaps merely to Calcutta, and at Sholapoor I am nearer the sea than I should be at Nagpore.

"If I am nominated I shall purchase all the Colonel's instruments, having (with the consent, of course, of the executors) first advertised them in the Gazettes of the

[1] Warren (82 *et seq*). [2] Geo. Everest (4–5). [3] Everest (16). [4] ib (18–9). [5] SGO. File, Feb. 1823; 134/43 F-111.
[6] DDn. 283 (121–3), 9-8-32. [7] Lord Amherst, GG. 1823–8.

three Presidencies. ... There were in his possession mathematical works which, if sold at an everyday auction, will hardly fetch their weight in marble, but if duly advertised will be worth nearly their weight in the same quantity of silver. I am myself ready to purchase nearly the whole of them (in the event of my being confirmed) at such prices as they may attain after being subjected to a full competition with the whole scientific world of India[1] [438].

He wrote at the same time to Jenkins, Resdt. at Nāgpur, but too late to prevent the disaster. Everything had been disposed of, "and many things...much below their value". "Such has been the precipitancy of the executor", writes De Penning, "that all the Colonel's personal property were disposed of by public auction on the 3rd instt. (the very day I got your letter), even before we could get instructions from Mr. Jenkins who...had sent directions for a great number of books. ...

"The Circular Instrument was sold for 525 rupees [259]. Capt. Stewart, the Surveyor of this district bought it up [93], so that the instruments and books, with the exception of some that Mr. Rossenrode bought up for you, ... is irrevocably lost to the public. I have taken charge of all the public property—the transit, or levelling instrument, the astronomical telescope, a boning telescope, the 2 chains with all its apparatus, 3 small theodolites belonging to the Quarter Master General's Department, as also the standard scale; and...every thing that I knew...to be public property—and I have been obliged to rent a house for the instruments and guard at...50 rupees a month"[2].

Morton considered his action quite in order; "All the property of the late Colonel Lambton has been disposed of by public auction at Nagpore, with the exception of some of the mathematical instruments which he left to his son who was with him [473]. His other instruments...were sold, and purchased principally by Captain Stewart who is... surveying the Nagpore country. The Colonel's effects were delivered to me by a Committee...at my request and, as I could not remain at Nagpore, being detached from my corps, I was anxious to have them disposed of before I left, being the only responsible person present"[3].

Everest was indignant and, after making a full report to Govt. at Calcutta [443–4], hurried in to Hyderābād to try and recover as much as he could [256].

To De Penning he wrote; "I hope for your sake you have protested...in as manly and bold a manner as the nature of the circumstance and your own situation required. ... The instant the late Col. Lambton's death took place you were responsible for everything connected with the establishment. ... This affair will be sifted down to the bottom, and visited with the severest displeasure of Govt.; the injury to the public service is incalculable"[4].

Morton refused to take any blame, and said he was quite prepared to surrender all official papers and insts., and the Resdt. was reluctant to bring official pressure to bear; "Interference in the measures of an executor is at all times a matter of peculiar delicacy, the more particularly when those measures seem, to a certain extent, to have had the sanction of a Committee. The matter of complaint, moreover, did not occur in the territories of the Nizam, but in those of Bhonsla"[5] [90–1].

Tact was never Everest's strong card, and he soon quenched any will for co-operation on Morton's part. After recovering a few public papers, he wrote to Morton that "there were...a great number of articles of this kind in manuscript, and his private letters were so much intermixed with those of the public that...more than two-thirds of the papers you have retained relate to observations and calculations connected with the Grand Trigonometrical Survey"[6]. Morton replied that he had handed over "all the papers...except those of a private nature, and connected with money matters"—and again—"I am not authorized to allow you to inspect the papers and manuscripts...now in my possession, without the concurrence of Mr. Stuart, the other Executor"[7].

Morton agreed, however, that two officers from the Resdcy. should report on the papers in his possession, and in this way a number of survey documents were handed over to Everest. The remaining private papers were left with the Executors, and included—Lambton's correspondence with his agents both in Calcutta and London—Letters, books, and papers "wholly private"—a Private Journal—a ms. "Life of Colonel Lambton written by himself"[8].

Everest was still persistent and, by arrangement with the Resdt., was allowed to examine the papers still remaining with Morton, and, 26–6–23, expressed himself satisfied. He repeated this assurance to the SG., pointing out, however, the loss incurred by the sale of the circular inst., which was eventually recovered on the break up of the Nāgpur Survey in 1830 [92]. There was also a brass platform to another inst. sold to Stewart, which Morton himself succeeded in recovering for the GTS[9].

In Jan. 1824, Stuart, the second executor, sent Govt. "a list of valuable manuscripts belonging to the estate of the late Colonel Lambton, as Govt. might wish to have copies of them for their own private information, as well for the use of the Trigonometrical survey; ... under the guarantee, however, of their not being published except for the benefit of the deceased's estate.

"Six Mathematical Place Books—One Common Place Book—One Journal—Twelve small red-leather-covered manuscripts containing descriptions of Mysoor, the Carnatic, Soondah and Bednore, and Southern Provinces, etc.—Four manuscripts; journals connected with the geographical survey in 1807 and following years—One manuscript (blue-covered), comments on Newton's Principles[10]—Five small manuscripts; journals of the siege of Seringapatam in 1799—One bundle manuscripts; translations, etc.—One do. ... —Two blue-covered books on astronomy and sundry bundles containing letters, etc., etc.[11].

This list was passed to SG. for action direct with the executor, but no further record is found and no copies of any of these documents are now forthcoming. It is a tragedy that the various journals, especially the MS. autobiography, have entirely disappeared. It would be reasonable to presume that they were passed to young Wm. Lambton, and that he would have appreciated their great historical value.

There was found in GBO. Comp. in 1950 a leather-bound notebook, 7 inches by 4½, giving notes in Lambton's handwriting on comparison of chains at Bangalore base-line of 1804—obsns. of pole-star at Trichinopoly in 1808—with list of geogl. positions fixed on coastal series of 1802–3 [II, 236-57][12].

LAMBTON, William, jr. Sub-Asst. Survr. b., Pondicherry, 12–7–09. d., Brompton, London, 7–2–54.

3rd Sub-Asst. 1–7–21; disch. 25–7–23;
Arrd. England, 1824/5; MRCS., London, 10–4–35.
nat. son of William Lambton [*sup*] by an Indian mother.
m., St. George's Hanover Sq., 27–11–38, Eliza Ann Orlebar, dau. of Wm. Orlebar, solicitor, of George St.

[1] DDn. 172 (7–9), 6–2–23. [2] DDn. 91 (25–8), 14–2–23. [3] on return march to Hyderābād, 17–2–23, DDn. 91 (249). [4] DDn. 172 (15), 27–2–23. [5] DDn. 91 (261), 17–3–23. [6] DDn. 171 (85), 27–3–23. [7] Chas. Stuart, of Hogue, Davidson, & Robertson [II, 393 n.2]. [8] DDn. 91 (281–2), 23–4–23. [9] DDn. 197 (124), 7–11–23. [10] *Principia*; pub. London, 1686–7. [11] to Gen. Dept., 7–1–24; DDn. 205 (9). [12] now GBO Lib. Hv. 19 (5).

Lambton's will, sd. 20-1-23, gives following facts about surviving members of his family; previous wills revoked.

"To my natural son, William Lambton, I leave 30,000 sicca rupees, to be lodged in secure deposit; out of the interest he is to allow his mother, Kummerboo, a Moor woman[1], 24 rupees a month. ...

"To Eliza Lambton, my natural daughter, I leave 40,000 sicca rupees.

"I possess Government securities to the amount of 11,700 sicca rupees, and have just received a bill on Court of Directors to the amount of £5,149, which I have remitted home, & I have, besides, upwards of Rs. 50,000 in hands of Messrs. Davidson & Co., my Agents in Calcutta, ... still accumulating.

"To Frances, a half-cast woman, and the mother of my natural daughter Eliza, I have settled a pension of 40 Hyderabad rupees, or 33 sicca rupees nearly.

"After providing the above, I leave remainder to be equally divided between my two nephews, Thomas Lye & William Lye, sons of Mrs. Dorothy Lye of North Allerton in Yorkshire, on consideration they allow her a third part of the income during her life.

"Mr. L. A. Davidson[2] is appointed Guardian of Eliza.

"In addition I give to William, my natural son, my small Theodolite & silver case of Mathematical Instruments" [473].

Probate was granted to Charles Stuart, Calcutta, 11-2-23[3].

Register of Baptisms, Diocesan Registry, Madras, gives the following particulars;

Baptized, 18-6-1810—Name, William Lambton—Father, William Lambton, Major—Station, Pondicherry—Bapt. by J. G. Holzerberg, missy.—Born, 12th July 1809—Sponsors, [Père ?] Bonnefoy, L. Cicéy, Miss Génévieve Cicéy[4].

Lambton had spent Aug. to Oct. 1808 at Trichinopoly repairing his great theodolite [II, 241], and had then carried his great arc to Cape Comorin. He was in Travancore Feb. 1809, and retired to Pondicherry for work on reports and compns. in time ready to welcome young Willam [II, 243].

Eliza was b., Hyderābād, 6-8-19, just after Lambton had reached Calcutta, and was bapt. 5 days later. A second son, John Wm. was b., Hyderābād, 26-12-20, pr. by Frances, Eliza's mother; he was bapt. 4-4-21, and pr. d. young, for we hear nothing further of him.

Young William may have been ed. at Vepery Academy, under Mr. D. Kerr, of which an adv. appears in *Mad. Govt. Gaz.*, 17-4-23[5]. No record of him exists in records of the *Lawrence Memorial Royal Military School*, Lovedale, Nilgiri Hills, which was formerly the Military Asylum at Madras. He was only just 12 years old when he joined his father at Hyderābād and was appd. to GTS. [379], probably working with young Joseph De Penning who was slightly older [385]. He was in the camp at his father's death, and Morton writes to Everest 17-2-23; "I wished also to ask your opinion regarding the late Colonel's son. No person has been nominated guardian to him, and I suppose the executors must look after him. Do you think it advisable that he should remain on the survey establishment? He is very young, and I should imagine the best place for him would be at school. He is left 30,000 rupees, and as Mr. De Penning, under whose care he is, talks of leaving the survey [438-9], what is to become of him? He is too young to take care of himself.

"But you must be the best judge what his prospects in that line may be. ... I am thus far on my way to join my corps, the 2 Bn. 20th [MNI] at Secunderabad, where I expect to be about the 10th of March. I have all the Colonel's manuscripts, which are numerous. Should you think it advisable for William to return to school, how is his leave to quit the survey to be procured?"

"There can be little doubt that William has been taken away from school too young, and [he] certainly ought to return"[6]. Though Morton here appears by no means unreasonable, Everest had by this time broken off corr. with him, and a series of stiff official letters brought Govt. authority to young William's discharge[7] [380, 494].

Lambton's estate became the subject of a series of law suits in the Court of Chancery between 1828 and 1832, under which his children Wm. and Eliza sued Davidson for their legacy, and sought an injunction against their uncle and cousin, Thos. and Wm. Lambton Lye.

1829, Case B-2401, 11-8-30:—

Plaintiffs; Wm. & Eliza Lambton, represented by their next friend, James Bathgate[8].

Defendants; Leith Alexander Davidson with 9 others, including Wm. Lambton Lye, Thomas Lye the elder, and Charles Stuart.

"Wm. Lambton the father of the Plaintiffs was, at the time of death, possessed of, or entitled to, a large personal estate; part thereof was then in England, & part in the E. Indies. ...

"Charles Stuart became, and now is, the sole legal personal representative of the Testator in the East Indies. John Morton having declined to prove the will, letters of administration were duly granted in London to L. Alexander Davidson, now of Bruges, Netherlands, ... sole representative in England.

"At the time of Testator's death there was standing in books of Government &...Bank of England, £1,005 @ 3%, in hands of Fletcher, Alexander & Co., a large sum of money amounting to £5,000 and upwards. Further possessions in East Indies".

Wm. Lambton Lye had lately been declared bankrupt. His bro. Thomas d. Dec. 1825. Their mother, Dorothy Lye, wife of Thos. Lye senr., d. Feb. 1827, leaving her husband surviving.

"The Plaintiffs have frequently applied to Davidson & Stuart to make a proper investment of the two legacies of 30,000 sicca rupees and 40,000 sicca rupees respectively.

"The Defendants reply that suitable investment has been made in India, and that the Residuary Legatees are entitled to the whole estate in England, which the Plaintiffs deny. They state that Stuart sold all the testator's Govt. securities in the East Indies and, after meeting funeral expenses etc., converted these monies to his own use, or for his own benefit. ... That the testator's funds in the East Indies were not alone sufficient to meet the legacies, ... and that ample funds exist in England to meet these legacies, which are now in the hands of the Defendants in England.

"These are claimed by the agents of W. L. Lye & executors of Thos. Lye, who refuse to allow any part to be applied to the benefit of the Plaintiffs, & various sums of money have been paid out to them on this account. The Plaintiffs ask for an injunction to prevent any further payment to the Defendants.

"The Defendant's [Davidson's] counsel states that the Defendant was unable to make any investment for...providing bequest to the plaintiffs. He believes that upon, or very soon after, the death of the testator, the said Charles Stuart possessed himself of all the testator's estate, & on or about 30th April 1825 Stuart transferred a sum of Rs. 21,308 to the credit of the guardian of plaintiffs Eliza, and a sum of Rs. 21,308 to the credit of Wm. Lambton; a sum of Rs. 5,000 was retained for pension of[9]—, named in the will.

"To the best of his knowledge, C. Stuart never invested or appropriated any part of the estate, ... and he cannot say whether Stuart hath now...any

[1] muhammadan [I, 300 n.1]. [2] Leith Alex. Davidson; arrd. India 1803; d., Calcutta 22-5-41, aged 70 [II, 393 n.2]. [3] Ben. Wills, 1823. [4] might read Licey. [5] *As J.* Dec. 1823 (607). [6] DDn. 91 (249). [7] BMC. 25-7-23; DDn. 197 (75). [8] probably a solicitor. [9] obviously Frances, Eliza's mother, pension paid thro' Palmer & Co., Hyderābād.

sum of money belonging to the estate. He has received information from C. Stuart, who was in the East, that the property of the testator in the East Indies was insufficient by Rs. 15,000 to satisfy the legacies. Stuart desired the Defendant to remit the same out of the monies in the hands of the London Agents, and this was done in April 1825. The London Executors, considering that this remittance satisfied the requirements in the East, ... made more inconsiderable payments to the Lye's on account of their shares of the residuary estate.

"Davidson heard in April 1826 that the firm of Davidson & Co, including C. Stuart, had in December 1825 become insolvent and stopped payment, whereby the funds belonging to the Testator's estate, then in the hands of the firm, were no longer sufficient for that purpose, and the question now arose as to whether that part of testator's estate now in England ought to be appropriated to satisfy the legacies to the Plaintiffs. ...

"He says the Plaintiffs were at Testator's death in the East Indies, but after his death they were sent to Europe for their education by Ch. Stuart, to the care of Davidson, and have no other provision than their prospective legacies. The plaintiff Wm. Lambton is an infant; Eliza is an infant; Kummerboo & Frances & Stuart are now in East Indies.

"The Agents state that they still hold £3,600 of testator's estate. They deny that they threaten or intend to pay over any sums of money to the Lye's, unless they shall be directed to do so by the Court, inasmuch as the funds in the East Indies have failed, owing to the insolvency of Davidson & Co., & Palmer & Co.[1].

"Since arrival in England the Plaintiffs have ever since been, and are now, under the charge of L. A. Davidson for their education.

"The Court doth *Order* and *Decree*...to take an account of the personal estate of the Testator, & to advertise for all creditors, ... and that all funds with the Agents be paid into the Court's Bank. ... The Master to appoint a proper person, or persons, as Guardian of Eliza, & to report who has maintained & educated Eliza since the death of the Testator, and what ought to be allowed for such purpose; and similar information re William".

Orders in Chancery—1830-B-2167; 4-8-31.

"Wm. Lambton, the Petitioner, is actually in a state of destitution, & has no means of support, & has nothing to rely on but the said legacy. No creditors have come forward. ... It was fit and proper that the sum of £200 should be advanced & paid the petitioner pending the proceedings in this suit; paid out of the sum of £4,300 standing in...trust".

Orders in Chancery—1831-B-2465-7, 9-8-32.

Further dividends having been paid by the insolvent firm, "McKillop & Co., of Calcutta should now remit to the Court the sum of Rs. 14,638, or £9,321, together with interest accrued.

"Ever since the arrival of the petitioner in this country, which was in or about the year 1824, down to the present time, he and Eliza had been under the care of L. A. Davidson, and had been maintained and educated by him. ... Davidson is now residing at Boulogne in France with his family, but is in the habit of occasionally visiting this country and, in the opinion of this Court, the most fit & proper person to be appointed Guardian of Eliza is this L. A. Davidson.

"Eliza is now of the age of 14 years. She has no relations, being the natural child. Davidson has maintained & educated Eliza since the death of the testator at a cost amounting to £659; and it is recommended that £75 a year be allowed for future maintenance & education, & be paid to Davidson from the income arising from the legacy.

"It is ordered that the Master do apportion such part of the dividend & interest between the 3 Plaintiffs according to their interest; such part as shall be apportioned to Wm. Lambton [shall] be from time to time...paid to him, from which he will pay the amount of Rs. 24 per month to Kummerboo for her life, and such part as shall be apportioned to Eliza shall be paid to Davidson, her guardian, for her maintenance & education during her minority".

Orders in Chancery—1832-B-1207, 22-3-33.

"The Petitioner L. A. Davidson being about to leave England for the East Indies, it is desirous that some person should be appointed Guardian to Eliza in his stead. There remain £3,029 between Wm. and Eliza".

Orders in Chancery—1832-B-2657; 2-8-33.

"Balance, after charging all costs, now available for division amounts to £2,900;

£1,218 plus 18 to William Lambton;

1,644 plus 24 to Eliza Lambton.

"*Proposes George Munday, of Southampton Bgs., Chancery Lane, as guardian of Eliza, & control of her funds*".

Under an *Order of Chancery, 1829-B-1455, 1830*, Thomas Lye and his son Wm. Lambton Lye were summoned to appear, and to settle a claim made against them by William Lambton. Thomas was at the time "a prisoner in custody of the Sheriff of Yorkshire", presumably for debt.

The gist of all this appears to be that Lambton's children were sent to England in 1824, William then being 15 and Eliza about 5 years old. Here they were provided for and educated by Leith Davidson, who seems to have treated them as part of his family. Unfortunately his Calcutta firm got into financial difficulty at the end of 1825, and had to suspend payment. The London agents, having sent out sufficient funds to India to complete the legacies to Wm. and Eliza, started to make advances from the residuary estate to the Lye's, Lambton's bro.-in-law and nephew. Wm. and Eliza appealed to Chancery and had these payments suspended, and their affairs were then taken over by the Court of Chancery.

The final payments made in 1833 included the sums rescued from the wreck of the Calcutta firm, under whose arrangement they had been maintained and educated for ten years.

We have further infn. about William and Eliza from a most interesting letter written by Wm. to Joshua De Penning in 1834, that is preserved by the De Penning family [II, 394]. It is given below with but few cuts. Wm. was now 24 years old.

No. 8 Duke Street, St. James's Street, London.
24th January 1834.

My dear Mr. De Penning

Since I received your last letter about two years and upwards ago, I had written to you three several times, but whether the letters reached you or not, it is impossible for me to say, but I have never heard from you. My last packet

[1] Several other Calcutta firms failed at this period.

of letters was sent out by the Neptune, Captn. Cumberlege, who took charge of them *himself*, and promised me he would deliver them safely. The Neptune has returned to England—but no letters from you[1].

I am in a state of great anxiety and suspense about the residue of the money that was to have come from India, agreable to an order sent out by the Court of Chancery to Cruttenden & Co's house at Calcutta. In consequence of the delays occasioned by our unfortunate suit, I am at present, and have been, struggling against the tide of difficulty which had well-nigh overwhelmed me. I have been enabled, however, by the kindness of some of my friends to have nearly *scraped* through my professional studies, and am in great hopes of being a Member of the Royal College of Surgeons by the latter end of the present year [469, 473]; if so my profession may do something for me.

The precepts inculcated by you in my youth, My dear Mr. De Penning, has [*sic*][2] proved more useful to me than mines of gold; it has obtained me friends! As an illustration of this fact—will you as soon as you have received this letter call upon Captn. Joseph Andrews, of the H.E.I.C.'s service, commanding the Andromiche, who I am personally acquainted with, and hear his opinion of me? I was intimate with him and his family at Bruges in the Netherlands for two years. He will take charge of this letter for you! Ask him what he thinks of my Theatrical talent! As it was my intention some time since of going on the stage, but which I was obliged to abandon. ...

My life has been chequered by various vicissitudes, like a ship in a stormy ocean—buffeted about—first in England, then in France, then in Belgium; at the latter place during the revolution of 1830 I was shot, and nearly lost the use of my leg—Captn. Andrews can give you all the particulars as he was there at the time. Last year I was on a visit with a friend at St. Omer in France, where I was appointed dresser to the military hospital. I had 120 patients under my charge—principally Dutch prisoners from the siege of Antwerp[3]—I had a good opportunity of seeing the process of curing gunshot wounds—as well as the French treatment of the venerial disorder—for which they are so justly famed. When I was obliged to leave France to resume my studies in London, Le Chevalier Chrestien, the Surgeon in Chief gave me a handsome set of surgical instruments—and a certificate, for which this is a true copy—

'Je soussiné—Chirugien en Chef de l'Hôpital Militaire de St. Omer—déclare que Monsieur William Lambton a suivi les pensemens journaliers debit Hôpital—pour l'espace de quatre mois, et pendant tous ce tems il a montré beaucoup de zéle et assiduité—en foi de quoi j'ai delivré le present'. ... Chrestien.

Thus then you perceive I have not been losing my time.

As touching theatricals, I have had various offers of engagements. When on a visit to Canterbury, I played two nights—Iago—in Shakespeare's tragedy of 'Othello'—and Nicolas Flam in a new farce of that name—House crowded both nights. Captn. Andrews, who has seen my personation of old men in comedy, will be more able to give you his opinion on the subject. Please see him and write by him, if you please.

How is my poor Mother? I wish to God I could once more see her. She was always most affectionate towards me, and would it were in my power to assist her. I should not like her to see Captn. Andrews—for causes which you can best devine—therefore you had better say nothing to her of him.

I hope Mrs. De Penning is quite well—give my *Love* to all—Caroline—Eliza—and little Adelaide—I suppose they must have grown up quite *belles*. Eliza as far as I remember for her eyes! Caroline will take more after the placid manner of her mother—Ady—a little lively *puss*! You see I make quite free in saying what I think—but be it remembered that altho' I am now 24, I speak with the tongue of youth in recollection of those happy days the French Gardens used to afford us [437]—I never recall to my recollection those days without a high sensation of pleasure—and well do I remember them—The house and garden at the back, walled round—the little bridge thrown over the nullah—the square well which supplied the water for the garden by the aid of 2 bullocks—all—all—all live in my brain—I cannot write collectedly of them, for too many ideas rush together in my mind on purpose to *bewilder* me.

My sister Eliza is quite hearty and strong—rapidly growing into womanhood—and is exceedingly *clever*—plays the pianoforte beautifully—knows history and geography well—in fact, very accomplished for her age—but not pretty. Her disposition is getting better. Pray, what is her age—date of birth—baptism—and is her mother alive [470]? She is now at school at Mrs. M'George's, No. 3 Wilton Crescent, Belgrave Square. If you wish to write to her, enclose her a letter to me.

London is a gay place, but to enjoy yourself—you must have lots of money—paucity of that article makes a poor devil like me quite miserable. I'd as lieve be in the wilds of Africa as here, if I had no friends.

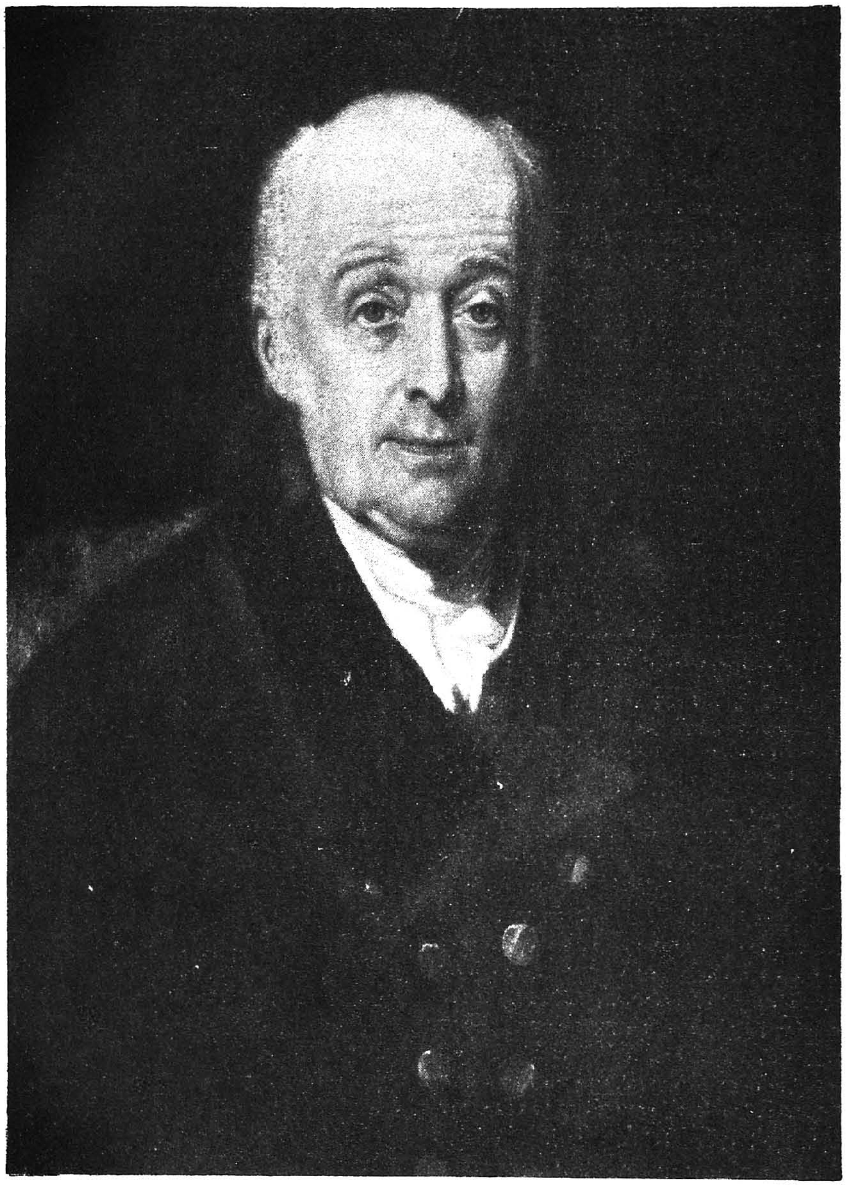
I must now detail to you a very singular circumstance connected with a friend of mine, now practising at the bar in the island of Trinidad, West Indies. I was at school with two brothers of the name of Souper—sons of a Captain in the Army[4], now living at Canterbury on half pay—they were both very clever, and very fine young men. Mowbray—the younger brother—formed an attachment to a widow lady—old enough to be his mother—married her at the age of 20—and lived in *misery*. George—the elder brother, and myself have sworn friends—took an oath never to separate from each other (but by marriage). Strictly to our articles of agreement, we pushed thro' 5 years of poverty—assisting one another as means were afforded to either—lived almost secluded from the world in a garret in Villiers St., Strand. Fortune during this long period never once favoured us—our excursions to the Continent and back were the only respites to the monotony of our lives. We were each obliged to remain in London during the winter months—he to keep his terms at the Temple—I to attend my lectures.

By some chance Mowbray found out where we were—called upon us—dined with us on red herrings and potatos. After this humble meal he declared his determination to leave England for the Portuguese service, having as he stated, previously accepted a Surgeoncy in the British Brigade—and with a wild frantic exclamation wished *never to return*!! Home had no charms for him—and he wept bitterly when he said he would willingly change his lot for ours. Alas! Ours...was anything but enviable. All we could say—all we could do—could not wean him from his purpose—he would go—and in consequence sailed the next day to join his regiment.

Colonel Hodges[5], commanding the regiment in the service of Don Pedro[6], took a great fancy to Mowbray, and...the new scene...divested his mind of the sorrow brooding over it. But, Alas! His original determination took...root—he was determined to throw up his Surgeoncy and take a commission in the Line. Colonel Hodges at first refused, as his services in the medical department could not be dispensed with. Poor Mowbray's importunities at last overcame the Colonel's objections—he obtained his Lieutenancy—went into action the next morning—and got shot through the head!! Deeply lamented by all who knew him.

Poor George was quite disconsolate at the of his loss brother—and in consequence we were determined to go and board in a family. A lady living in the family...at first sight fell in love with George—a month after we entered the house they were engaged. George explained his distressful situation—his debts, &c.—No, nothing could dissuade her from her love for him. ... She was pleased with his candor—he with her generosity. Her fortune was £300 a year—with the expectation of a large property at the demise of her

[1] By 1834 De Penning was settled in Calcutta, *not* Madras [439]. [2] There are many such slips in the original. [3] captured by French under Marshall Gérard, 23-12-32, after 3 weeks siege. [4] W. H. Souper; Pymr. 1801-34. [5] not identified. [6] Pedro I of Brazil and IV of Portugal; d. 1834.



WILLIAM LAMBTON (1753/6–1823)

As Lieutenant in H.M. 33rd Regt. of Foot, and Brigade Major, King's Troops, Madras, initiated his trigonometrical and general survey of the south peninsula at the end of 1799 [II, 233–67]. This was transferred to the Supreme Government from 1818, as the Great Trigonometrical Survey of India [225–7].

Corresponding Member of the Institut de France, and Fellow of the Royal Society, 1817.

Died in camp at Hinganghāt south of Nāgpur [236].

From an original portrait in oils, in possession of the Royal Asiatic Society [II, 411].

Reg. No. 4857 HD '50–800'52.

Printed at the Survey of India Offices (H. L. O.)

COLIN MACKENZIE (1754–1821)

Madras Engineers, C.B. ; F.R.S.

Survey of Mysore 1799–1808 (II, 91–121). First Surveyor General of Madras 1810–15, and first Surveyor General of India, 1815–21 [II, 419–28]. Made a remarkable collection of historical antiquities.

Died on Hooghly River near Calcutta.

Enlarged from original oil painting by Thomas Hickey, 1816 [II, 419 ; pl. 22].

REG. NO. 4858 H D'50 - 800'52.

PRINTED AT THE SURVEY OF INDIA OFFICES (H.L.O.)

father-in-law. George was called to the bar last year, married, and went out to the West Indies. Five months after their departure for Trinidad, the father-in-law died, and she is now come into £500 a year during her life. The lady is the widow of Captn. Thomas Gooch, of the 47th Regt., and niece of Sir Thos. Gooch, Bart.[1], many years Member of Parliament for Suffolk.

In consequence of this death, they will return to England, and I am to live with them—till I get married. If my fortune prove as propitious as my friend George's, I may still become *a useful member of society*. In my next letter I shall give you more news of this, and other prospects—you must not be at all surprised if you hear of my *marriage*! Fortune is nearly tired of making a football of me any longer. If I am not destined to be bound in the trammels of Matrimony, you may expect to see me appointed Surgeon to one of the merchant vessels to Madras.

Remember me to all friends who enquire after me. *Kindest love* to my mother—tell her *means*, not *will*, prevents me from assisting her at present, and as soon as I am able she shall hear thro' you. Love to Mrs. De Penning—Caroline—Eliza—Adelaide—and *all other new comers*, and Believe me ever to remain, My dear Mr. De Penning,

yours sincerely attached, obliged, & very affect. friend!
William Lambton.

P.S. One favor above all I have to request of you is to send me my Father's portrait by Captn. Andrews [467]. I shall get it copied *here*—and send it back by the same gentleman. You may rely on his taking care of it. You will see him, as I have mentioned it. It is the greatest favor I can ask, and—on my honor—you shall have it in a 12 month after you send it.

What is become of Dr. Morton—he had my...theodolite [470]. I wish you would find out...and send it to me. Remember me to Joe[2] if you write to him—all Hyderabad friends likewise—Mr. Camaratt [385]—Messrs. Rossenrode & Olliver [378]—Is Captn. Everest commanding the Survey?—Give me all the news. God bless you all!.

Joshua De Penning Esq.,
Vepery, Madras [317]. East Indies. *W.L.*

The handwriting and signature are remarkably like his father's. We do not know whether the portrait was ever sent home and copied—probably not. It is a pity young William did not know of the full-size portrait hanging with the R As Soc. [pl. 22].

The records of the Royal College of Surgeons show that he was admitted member, 10-4-35, and give his known addresses as:—

1837. Sloane Street—1838, Rotherhithe—1840, Paradise Row, Rotherhithe—1844, George St., Hanover Sq.—1745, No. 1 Upper Queen's Buildings, Brompton, where he was living at the time of the census of 1851.

The Medical Directory of 1852 shows that he became a Licentiate of the Soc. of Apothecaries, 1839, and had at various times been

Asst. Surg. to Mil. Hosp., St. Omer, France.
Surg. in the Brit. Aux. Legion of the Queen of Spain.
Surg. to the Parish of St. Mary, Rotherhithe, and to the M. Subdn. of Police.
Member of Western Med. & Surg. Soc.
Contributor of various papers to *Lancet*, 1837-8.

With this record we may confidently claim that his wish was granted, and that he had proved "a useful member of society".

LAURIE, John. Mad. Inf.
b. 18-8-1791. d. 20-7-61.

Ens. 29-7-10 ... M Gen. 28-11-54.

Son of Rev. John Laurie, minister of Ewes, and Anne Grieve his wife.

m., Jālna, 1-5-27, Miss Catharine Fenwicke.

July 1814, MMI., cl. VIII [II, 321]; Marātha War, 1817-8, survd. route with Malcolm's column[3].

LE MESSURIER, George Paul. Bo. Inf.
b. 10-7-01. d. 6-2-52, unm.

Lieut. 30-12-18 ... Lt.-Col. 2-3-46.

Son of Peter Le Messurier (1772-1832), senr. merch. Bo cs., and Harriet his wife, dau. of Commodore C. J. Bond, Bo. Mar.

ed. Charterhouse.

Oriental Club.

Bo GO. 19-8-22, attd. to Deccan Svy.; BO RC. 98/1823 (192), to be survr. with allces. from 19-11-22, Jopp reporting his work "extremely accurate, and his plans neatly finished" [125 n.11].

BO GO. 25-10-23, promoted to Survr. 1st cl.; 1825, furl. to Cape.

1838-42, Supt. of Sind Svy., making a number of svys. in Sind and Baluchistān [426];[4] AQMG. Sind Force.

Auth. of *Memorandum on Baluchistān*[5].

LESLIE, James Fraser. Mad. Inf.
b. 3-7-04. d., Singapore, 31-5-42.

Ens. 13-2-21; Lieut. 1-5-24; Bt. Capt. 13-2-36.

Son of Robert Wilson Leslie of Belmont.

1827, survd. route into Siam; left Moulmein in 17-4-27, via 3-Pagodas, carrying letters from Sir Archibald Campbell to Bankok; reached Kambori, 20th May—"severe attack of fever—anxious to return by land, but could not persuade Governor to allow me to do so—Left it on the 11th June for Moulmyne, bearing letters in answer to those taken by me"[6] [77].

LOW, James. Mad. Inf.
b. 4-4-1791. d. 2-5-52.

Ens. 11-6-12 ... Lt. Col. 31-12-14; ret. 21-11-45.

Son of Alexander Low, of Kettle, co. Fife, and Anne Thomson his wife.

1822, on duty at Penang, PWI., compiled map of Indo-Chinese peninsula [80].

1824, on outbreak of Burmese war, deputed as envoy to Rāja of Ligor[7], on abortive mission to obtain "co-operation of the Siamese with the Rangoon expedition, and especially by means of a fleet of boats. ... We sailed on the 7th May 1824 [from Penang], and proceeded up the Keddah coast. ... 19th; Anchored in Trang harbour. ... On the 1st June our captain...stood out of Junceylon harbour. ... We returned to Trang on the 7th June. ... Three envoys who had just arrived from Ligor came aboard"[8].

Sept. 1824, with mission to Tenasserim under Lt Col. Snow, making svys. to Tavoy, Ye, and Martsban till Oct. 1825; compiled maps, *IO Cat.* (308-9) [74, 75 n.4, 80].

1826, being stationed at PWI., deputed to report on Perak, Malaya[9].

Continued on pol. duty at PWI., contributing to ASB. several papers on Malaya, and Buddhist religion; *JASB.* XV, 1846; XVII, 1848.

MACAN, Robert. Asst. Rev. Survr., uncov.
b. 1804-5. d., Allahābād, 18-10-30.

Appd. Asst. Survr. 9-7-24.

Son of Robert Macan, banker, of Newry, Ireland, and Margaret Gillespie his wife; bro. of Clements Gillespie Macan [1803-67] and John (1800-51 ?), both Ben. Inf. (Hodson).

ed. England or Ireland.

[1] Sir Thos. Sherlock Gooch (1767-1851); 5th Bart.; *OW.*, I (380-1); MP. Suffolk 1806-30: his 1st cousin, Capt. Henry Robt. (not Thomas) Gooch; m., 1822, Eliza, dau. of Samuel Wayth, of Southwold, and dsp. 1829; Eliza m., 2nd, Geo. Fredk. Souper. barrister. [2] Joseph De Penning [379-80]. [3] Kaye, II (174). [4] MRIO. 116 (3, 34); 160 (2, 3). [5] *JRAs Soc.* (*Bo*), II, 1845 (139). [6] DDn. 219 (225). [7] Malay Peninsula, 8° N., 100° F. [8] *JASB.* VII, 1838 (459, 583-608). [9] HMS. 670 (171-2); 674 (321).

BTC. 9-7-24 (57-9); "Is a person of highly respectable connexions, and was intended for the Army, but circumstances have hitherto prevented his obtaining a Cadetship or Commission", and "having produced satisfactory proof of his qualifications, has been appointed Assistant Surveyor" on Rs. 250 p.m.

Posted to Gorakhpur Rev. Svy.; but owing to outbreak of Burmese War diverted to mil. service, and eventually accd. Birnie Browne to Burma [72, 427]. On joining Gorakhpur Svy. 1-1-27, was first reported by Wroughton, as "quite inexperienced" but soon became a useful survr. [152, 370].

BTC. 28-9-30 (23-4), on sick leave from 25-7-30.

MACDONALD, Roderick. Ben. Inf.
b. 12-4-04. d. 3-3-37; MI. St. Cuthbert's chyd. Edinburgh.

Ens. 23-2-22 ... Bt. Capt. 23-2-37; furl. 5-1-36.

Son of Alexander Macdonald, HM. 43th Ft. and Christian Macleod his wife.

ed. Sandhurst. Hodson III (127).

BTC. 19-1-27, tho' recdd. for appt. to rev. svy., could not be "spared from his corps, as there are already five officers of it holding staff situations"; 24-1-28, appd. to Rev. Svy. Sahāranpur, travelling up from Calcutta [158, 334].

30-1-29, tr. to Sahaswān, Budaun [154]; 1-3-31, granted 7 mo. leave to hills on mc.; BTC. 1-11-31 (30), 3 mo. leave to Calcutta; 12-3-32, tr. to GTS.

McGRATH, John O'Driscoll. Ben. Inf.
b., Cawnpore, 6-8-1794. d., 18-8-25, Ramree, Arakan.

Ens. 1-9-12 ... Capt. 1-10-24.

Son of John McGrath (d. at sea off Java, 2-8-11), Ben. Inf., and Mary McCabe his wife.

Hodson, III (136).

MBIO. 46 (35), svy. of roads in Singbhum, offg. as AQMG. 1821-2.

MACKENZIE, Colin [I, 394-52 ; II, 419-28]. Mad. Engrs.
b. 1753-4, Stornoway, Lewis I, Hebrides. dsp. 1-5-1821, on Hooghly R., nr. Calcutta. MI. Eye chyd. Stornoway.

Ens. 16-5-1783 ... Col. 12-8-19.
SG. Madras, 1810-5; SG. of India 1815-21.

2nd. son of Murdoch Mackenzie, merch. and 1st postmaster of Stornoway, and Barbara his wife.

m., Batavia, 18-11-12, Petronella Jacomina Bartels, of Trincomalee, Ceylon, who m., 2nd, at Capetown, 18-2-23, Robert Page Fulcher (1800-84), Ben. Inf.,

CB. 4-6-15; FRS. 10-6-19; *DNB.*; *DIB.*; Wilson, HH., 2nd edn.; *JRAS.* I (333); *GM.* 1821 iii (378); bio. by W. C. Mackenzie, pub. Chambers, Edinburgh, 1952.

Portrait, with 3 Madrasi members of staff[1], painted by Thos. Hickey (*DNB*), Madras, 1816 [pl. II, 22]; enlargement of head and shoulders, *v.* pl. 23 of this vol.

Arrd. Madras, 2-9-1783, as cadet of Inf., but tr. to Engrs. in 1786 from original date of 1st comn.

1784-90, various svys. in Dindigul, Nellore and Guntur—1790-2, Mysore war, svys. and ADC. to CE.—1792-8, with Nizām's Subsy. Force, making svys. and maps of Deccan, being called off for operations at Pondicherry and Colombo, and for Manila expn. [I, 111-2]—1799, on engr. duties at siege of Seringapatam, and maps for Mysore Comn. [I, 119].

1799-1808, in ch. Mysore Svy. [II, 91-121]; 1808-10, Bkmr. Mysore, a sinecure post which allowed residence at Madras, and time to pursue geogl. and archæol. work, with distant ch. of Ceded Dists. Svy. [II, 152-6].

1810-5, SG. Madras, being absent four years—April to Oct. 1811, CE. Java expn.—Oct. 1811 to July 1813, on special duty, maps, rev. and archæol. svys., Java—1813-15, on duty in Bengal completing Java reports and travelling in Upper Provinces [II, 135, 293-4, 408, 424-7].

MGO. 15-4-15, arrd. Madras 30-3-15 to resume duty as SG.; BGO. 1-5-15 and MGO. 26-5-15, appd. SG. of India, with hdqrs. Ft. William, but permitted to remain at Madras for re-organization of svys.

Remained at Madras till July 1817, making meticulous examination of past svys. and existing maps, and planning future svys.; re-organized ests. and accounts, and during 1816 sent out fd. parties under—Garling to Nizām's Territories—Ward to Travancore—Conner to Coorg—and Mountford to Guntūr [94-5]. He writes in May 1816;

"Govt....have permitted of my having access to all records regarding the Surveying Establishment. ... I have...looked for articles explanatory of the Surveys, & have carried it down to about 1771. I could wish much to be able to complete it till 1806, but the current duties here impede much my endeavours. ...

"I last week sent in the first part of the General Report, ... the expense of the Surveying Department for the last 52 years [95]; it was a most laborious job to extract from a variety of documents. ... I am ever at home, from the necessity of attending to business here"[2].

The Supreme Govt. made several attempts to hasten his move, and in April 1816 provided for him and his family in "H.C.'s Yacht Phœnix". Mackenzie did not think his reports would be ready; "I myself applied for the means of a passage, as I was put to a prodigious expence between Batavia, Calcutta, & Madras for passage money, tho' on public duty. It would mortify me much to leave this work undone, on which I have bestowed much pain; it almost sickens me, but it approaches to a conclusion"[3].

The *Phœnix* reached Madras on 24th June, and Mackenzie writes on 25th; "The captain has this morning been with me, who acquaints me that he is ordered, after surveying the Pulicat & Armigon Shoals [I, 102] to give me a passage to Calcutta. He is to proceed tomorrow on the survey, ... and supposes it will take 15 days at least. ... It would be very desirable to me to go rather in the Phenix, as I...have sailed in her already"[4].

When the ship called three weeks later Mackenzie writes to Criddle [74], the captain; "I hope, when it is convenient for you to land, you will do us the pleasure to come out here to breakfast or tiffing [*sic*]; we are always at home at these hours. I will this evening call at the Master Attendant's, at the offices on the beach, and the tavern, to see if you are come on shore, & bring you in the carriage to this house, when I hope you will do us the pleasure to pass the evening with us.

"I do not think it is possible for me to go off in 10 days, as the public business to be done requires much more time. ... Your account of the Pullicat & Armagon shoals must be very satisfactory...in explaining the nature of these dangers, that were erroneously supposed to consist of shifting sands. ... We hope you will be no stranger here while you stay; you can seldom miss me of a morning, as I generally am at home then"[5]. The Phœnix returned to Bengal without him.

[1] Intrs. Lakshmaiah and Dhurmia, and peon Kistnaji [II, 419 n.7, pl. 22 n.; III, 392, 464-5]. [2] DDn. 156 (38, 44); 5 & 14-5-16. [3] ib. (29), 5-4-16 to Josiah Marshall [396 n.2]. [4] ib. (68), 25-6-16. [5] ib. (72), 20-7-16; cf. official letter same date, MPC. 14-8-16.

Time was found for archæology. Ward found his tents pitched on the beach near the "Manvillypoor" pagoda, a few miles south of Madras [106][1], and in answering 3 letters of Sim's, Mackenzie writes, 22-7-16 ; "You will readily guess the cause of my silence—the old one—*much to do*. We had a very pleasant party lately to the Sèven Pagodas & have been rather fatigued, but very well, after it". He writes to Sim again, 14-12-16; "I suppose you saw Sir A. Johnstone on his way thro' Pondicherry. I passed two very pleasant days with him at Mavellipoor [481]. ... The ladies desire their best respects to you. I am in a hurry going to the Red Hills for the day & tomorrow. Write me often ; the oftener the better. ...

"Have you seen Monsr. Leschenault de la Tour, a celebrated French naturalist. We found at Mavellipoor two very singular fish, consisting almost entirely of *Head* ; it is called by the natives pallashee. I shall endeavour in a few days to send you drawings of them for the gentleman, with whom you should get acquainted; you may also mention to him that I can send him a drawing of a two-headed snake I lately sent to the Asiatic Society, with its description from a Tamull work [272][2]. I wish you would exert yourself to get me old coins".

He writes from Seven Pagodas, 5-1-17, to advise the Govr. of his "coming so far out of town for 7 or 10 days. The Doctor recommended a whole month, as a weakness of stomach renders some change of air & relaxation necessary, but I must be in by the 11th, on account of the Europe ships & various business. Indeed, I have thoughts of running in tomorrow night, in which case I may call on you on Tuesday, & then come back on the night following to enjoy this cool pleasant air for the rest of the week. It would be a pity to take Mrs. Mackenzie away from it sooner, as I consider it beneficial to us all"[3].

From Madras, 21-3-17; "I have been out of health & spirits for some time. ... I returned lately from Pullicat, where I had spent a fortnight on account of my health". And to his doctor, shortly before leaving; "I owe you for medical attendance...this last twelve month, wherein the care of my frail person must have too often broke upon your convenience. Be pleased to accept of the enclosed"[4].

Having been without prof. advice since the departure of Crawford in Dec. 1815 [II, 393 ; III, 300], the Bengal Govt. again asked Madras, 14-2-17, to give "every facility to Lieutenant Colonel Mackenzie in bringing the local duties to an early termination"[5]. They followed this up 6-5-17, by asking that he should "take advantage of...the expected arrival at Madras of the Sophia surveying vessel... which carries Sir John Malcolm on his return to your Presidency.

"Lieutenant Maxfield [II, 429], will...convey to Bengal at as early a period as possible the Colonel—with his family, baggage, and servants, and such of the documents and records—...and such persons (and their families, etc.) of the office—...as the Colonel may desire to bring round in his suite, or as there may be room to accomodate"[6].

After much bustle and considerable trouble, Mackenzie secured John Riddell [II, 439] for ch. of the office, and sailed in the *Sophia* 17-7-17, Riddell writing to Garling ; "Colonel Mackenzie embarked yesterday for Fort William. For some time previous ...he was very much engaged, and has been obliged to leave unanswered many letters from every quarter. For such omissions he requested me to make apologies to his friends, and most especially to you. He will take the earliest opportunity of writing to you after his arrival in Bengal"[7].

To Mackenzie he wrote the same day; "Remember me most kindly to Mrs. Mackenzie and Miss Bartels[8]. I am quite dull since you left me ; never go out, and wander up and down the large house without knowing where to settle"! Again, 3-8-17 ; "On Saturday I move into the house fornerly occupied by you. I have taken it for six months, and am always to have two months notice if desired to quit. The sale of your property takes place on Wednesday the 13th, and the house is immediately to be repaired. There has been a good deal of disputing between Kistnajee and the butler [318]. The latter had, it appears, carried off some articles to which he had no right. They are now, however, restored, and all is right. ... I have not a word of news for Mrs. Mackenzie. ... Mr. Bell, the Collector, died after a day's illness on Tuesday[9]. His loss will be a severe blow to the General. All the great people have left Madras"[10]—an exodus that was probably due to the Marātha war.

Again, 16-8-17; "I...congratulate you upon the happy termination of your voyage. I trust you will be benefitted by the effect of the sea sickness[11]. ... Your furniture has sold...very well. Kistnajee attended regularly. It may amuse Mrs. Mackenzie to see the catalogue. ... I have also forwarded some papers...from Mr. De Niesse[12], and some pumice stone from Captain Troyer [II, 447-8]. ... I never saw a person more attentive than...Mr. Binny has been[13]. He was almost constantly at your house, and took great care of everything. I shall, I am afraid, be a good deal in your debt for furniture, etc., but I trust to clear it off gradually.

"As I suppose you still care enough about Madras to like to see the Coast General Orders, I enclose those received since your departure. ... Any other thing you want will be immediately sent"[14].

Mackenzie's replies are equally chatty. He writes, Calcutta, 18-8-17, that he had reached the Hooghly 24th July [317]. "We landed here on the next evening in our own house[15], where we were immediately as comfortably situated as in that we had left at Madras on the 17th, only not so large as to admit the Office.

"Since...our arrival I have been so incessantly occupied in arranging...the office & establishment here [310]—in...communications with the offices of Govt.—& in paying & receiving visits at this populous Presidency, where we have many acquaintances—exclusive of the necessary attention to official authorities—that I could not sieze one moment, till this morning, to write you or any other at Madras.

"On board ship I was sick the whole passage, & had neither room nor ability to write, nor scarcely to read. ... I would have preferred myself having had ten days more at Madras ; ... there was no absolute necessity for coming round early. The Governor General had left this some time before I left Madras ; & is now arrived at Patna. ... All the official people have shown every disposition to facilitate my entry into the duties of the office, with that degree of hearty good will & confidence that inspires mutual confidence[16].

Riddell writes 8-9-17 ; "I...can easily conceive the load of business that must for a long time oppress you. I am glad your office is so soon to be comfortably housed ; a very essential circumstance, I find, for getting well through business. ... Your friends enquire constantly after you. Give my best remembrances to Mrs. Mackenzie and Miss Bartels"[17].

[1] Ruins of Mahavelly-pooram, Boriah, Dec. 1799 ; BM Addl MS. 29324 ; Goldingham, *As R.* V (69-80) ; cf. *Imp Gaz.* XXII (182-5), *sn.* 7-Pagodas. [2] DDn. 156 (102) cf. *As R.* XIII (329), *Venemous Snakes.* [3] to Marshall ; DDn. 156 (11). [4] ib. (114, 131). [5] MMC. 15-4-17. [6] BMC. & DDn. 142 (91). [7] DDn. 151 (71), 18-7-17. [8] Julia Bartels, Mrs. M.'s sister. [9] Wm. Bell (1788-1817) ; MCS. 1807 ; d. St. Thos. Mt. 30-7-17. [10] DDn. 151 (13-7), 3-8-17. [11] A well recognised panacea. [12] F. G. De Neize, Supt. Native Infirmary ; helped with Dutch trns. [13] Binny & Co. still a great business house 100 years later. [14] DDn. 151 (19-23). [15] engaged from Jan. 1816 [310]. [16] DDn. 156 (290). [17] DDn. 151 (31).

Mackenzie still kept up friendly corr. with Lambton, [II, 115–21; III, 465–6] and writes from Madras, 3–5–16;[1] "I sometimes thought of your operations at Delhi[2] & how desirable it would be to have the series carried up from Cape Comorin to the mountains north of Delhi. The Country about Delhi & as far south as the first part of Bundelcund & Malwa would be highly favourable & within our power, but I apprehend the difficulty would be from thence, about from N. L. 22° & 26°, to cross the country in the hands of the petty chiefs & native princes, under a jarring, unsettled government, so far as Ellichpoor. These are the difficulties I apprehend rather than from nature.

"You ask when do I go for Bengal & who has charge of my office at Madras. ... My detention at Madras will be only till I can complete the General Report here, part of which is done. A Yacht, the Phœnix, is coming round, on which I expect a passage[3] [474].

A year later 15–7–17; "I am quite in a hurry, about to embark on Thursday the 17th for Bengal. All are in movement here, one way or other. The first account of your proceedings, from 1800 to 1807, has never found its way into this office, & will be probably wanted, as well as a general chart ...of all your triangles, as references are sometimes made [116, 237]; ... for instance, the last year for the position of Tellicherry & Mahé, which was necessary in a discussion about the French Territory [113].

"Your friend Lieutt. Riddell is at last appointed in the charge of the Department for a time, at my particular request. ... I owe your letters of 11th & 30th May & 4th July 1816, which are now before me [465–6]. ... Let me have the pleasure of hearing from you in Bengal, & if you should ever find it convenient to go that way, you may be assured I shall be always glad to meet an old friend"[4] [466].

This personal friendliness did not prevent occasional irritation over Lambton's proposals for his staff, and jealousy of his regard for Garling [II, 115; III, 116, 343, 379, 450].

He writes to Riddell, 27–12–17; "It is unfortunate that the Govr. Genl. is up the country & God knows when he can return. You see the whole world is in arms against us. Surely this is not the time for undertaking new grand projects. Lambton's propositions to this Govt. I have seen [225–6]. It appears to me strange that he should be proposing such extensive plans when it would appear that he has views of going home [466].

"I concur in your idea that G—is the man [343], tho' I think it strange that, after the delicacy I have observed with Lambton's establishment, he should engage for any person in my establishment without some previous communication. ... Of Poonah and Nagpoor you must know before us. Holkar, it is said, shows signs of disaffection; & Scindia, I suppose, only by being surrounded [83]. This very day comes notice of a new & unexpected invasion by Silhet [64–5], ... and this is the time to extend the Trigonometrical Survey thro' an immense country in that state? What folly [223, 304]!"[5].

Mackenzie spares a letter for Mountford, now in ch. in Guntūr [96]; "Perhaps you may think me inattentive in not replying to your several favours, but, upon my word, I could not help it. It would be vain to offer any excuse now, the plain fact is always best. Ever since my arrival here, I have been kept in such a continual state of agitation and bustle, both by the duty of arranging a new office, by removals of house, and by necessary private interchange of civilities in a new place, that I have never forgot what I owe friends. ... Even my official correspondence has been too much retarded; but it is to be hoped all this will be remedied or my constitution could not bear the labor"[6].

In spite of his heavy duties in Calcutta, he continued to keep a tight control over official work at Madras, and maintained the warmest interest in the welfare of his old employees, whether dmn., survrs., or Madrasi interpreters and clerks. Riddell's letters came at least once a week, both official and private. He writes 13–7–18; "I trust the apprentices[7], perambulators, and beam compasses, arrived in safety. Of the mangoes I have no hopes. There is still an apprentice of yours here; I shall keep him ready if you want him. There are, I am sorry to say, small hopes of Newman [312]; he had lately a fever and was, on its ceasing, sent...to Pondicherry and Cuddalore merely for a change of air. Ramaswamy's business...goes on well [391][8].

Mackenzie was greatly distressed at Riddell's death [318], but found a worthy successor in Mountford, with whom he was equally cordial. He writes to his old *peon* Kistnaji, 9–11–18; expressing satisfaction with his "conduct, particularly to Mr. Riddell in his last illness, and your attention to the office after his decease. You are now under a very good master, for I hope Mr. Mountford will consider you an useful servant. ... Encourage the poor old Jain, Durmiah [II, 356; pl. 22 n.; III, 391]; his son is well"[9].

He writes frequently about material for his collns.; on 32–2–19, "I cannot conceive how the translations you mention from Valentyn[10]...came to remain. I suspect they have been part of what Mr. De Neisse sent in to poor Riddell [475 n.12], and that they were forgot. I have been missing them, and about to employ a Dutch translator here to fill up the chasm. ... I do not understand why the funeral expenses of poor Newman have not been paid; whether there be a balance due to him or not, he has just claims on me, and as the poor man has left no family, there should be less difficulty. Do me the favour, then, My Dear Mountford, to take this affair in hand"[11].

Again, 4–3–19; "I enclose you letters for my poor old servants, Kistnajee, Baboo Row, and Appoo[12]. ... I consider Kistnajee as a useful, valuable, servant and, considering the great saving effected, ... and the necessity of having the instruments, books, and papers, well attended to, I conceive his employment about the office on a pay superior to what he had before might be fully justified, under the denomination of store concoply [I, 290], or otherwise. ... His 20 years service with me ought not to be forgot".

23–3–19; "Now to your private letters, I thank you sincerely for the little heads of news. ... If you write them in a separate letter it may be more convenient; ... but you must not put yourself to expense of postage, ... for—all your correspondence with me arising from our official intercourse—it would be unjust to subject you to what no other person in like circumstances bears. I would without hesitation enclose them in the official cover.

"You will consider this a great effort; all in my own proper hand too (no great favour to your eyes tho')".

8–6–19; "I want the following articles, which I beg you will forward by sea, as soon as possible;

"1. A set, or even two sets, of camp tables, such as were sent some time ago, with ends complete, to serve for office or camp.

"2. A camp cot. ... I can get none here of the kind.

"Mrs. Mackenzie wants one or two pots of Alamparwa pickled oysters, and one of best tamarind fish. In my next I will furnish you the pecuniary orders. I could wish you to send me monthly an account balanced, how the cash stands, for you must not advance a rupee on my account; we are all subject to the Cholera Morbus, you know"[13].

4–7–19; "I am entirely in want of Madras news, and look for a gazette from you soon. Why did you not send me the catalogue of Mr. Ross's[14] books? ... All catalogues should be sent...as professional books are sometimes in them. ... The chest of books...arrived three days ago. I

[1] replying to Lambton's of 9–1–16 [465]. [2] our only ref. to Mackanzie's visit to Delhi 1814–5 [II, 426]. [3] DDn. 156 (35–6). [4] ib. (134). [5] ib. 27–12–17. [6] DDn. 154 (135). [7] Macpherson & Schencks [360 n.1]. [8] DDn. 151 (228). [9] DDn. 149 (23). [10] Dutch geographer [I, 221] [11] ib. (41). [12] elsewhere, "Appoo the Christian" cf. *JASB*. VII, 1835 (105–31), Appayu. [13] ib. (49, 51, 68). [14] Chas. Robt. Ross (1783–1816) MCS. [II, 362], son of MGen. Patrick Ross, Mad. Engrs. [I, 382]. d. Masulipatam, Nov. 1816.

hope the rest of the MSS. destined for the College will arrive with Howell and the apprentice" [374].

9-8-19 : "I am just off to Pultah[1] to reside for some time for my health. I will be down next week, and hear daily from the office".

13-8-19 ; Palta ; "I came up here by advice of the medical men on Monday last, and as it is necessary to abstain from business some time longer, I may advise you now that I have got your several letters, public and private, ... to all of which I hope to reply. ... I cannot at present enter into any".

20-8-19 ; Palta ; "My removal out to this place has had the happiest effect. It was near 20 days that I could not write a note from lassitude and weakness, added to the heat of the weather. I was obliged to go into Calcutta on Monday last, and since I came back I am very much better. I will gradually resume the consideration of business. ... Do not urge nor anticipate evil; your conduct in the charge has been very satisfactory to me".

Acknowledges "the chest of MSS., in which we found the three bottles of oysters, etc. ... Mrs. Mackenzie tells me the oysters and fish are very good, and we all desire to have another cargo of them before the season is over. You can send them with the tables, cots, etc., if possible in one cargo to save trouble; but...I trust that you make your servant keep an account of the expenses, and do not lose a fanam by our commissions, I beg [108 n,4].

Some time ago I requested Messrs. Binny & Co. to send you the plan of my house. ... If it could be sold a plan would be desirable. ... Riddell wrote me once that the house he was in at Vepery was getting out of repair, and I was on the point of directing him to occupy mine. ... His death prevented it. If you could get it rented by Government, ... I should still have no objection, but an adequate rent must be granted, and the house kept in order"[2].

Few constitutions can stand up to the Calcutta climate year after year without wilting, and Mackenzie's letters are more and more filled by accounts of his aches and pains.

He writes to Mountford, again from Palta, 7-10-19, apologising for delay in writing [319]; "This is not so much owing to ill-health, as to the intolerable load of public business thrown on me here. It will be corrected ere long I trust. ... My health is very much improved, but in the forenoons a degree of unusual inertness prevails owing, I think, to the effects of the medicine. The weather has been lately very close, sultry, and rainy—unwholesome at Calcutta—many of our acquaintances died, or are now sick. Mrs. Mackenzie is well, and thankful for your remembrance.

"Write me once a week, confidentially, clear of all parish business"[3].

The tiresome details of the work in Bengal never interested him as work had done in Madras; he knew hardly one of the survrs. in person. He was now 66 years of age, in poor health, and worn by the trying climate [442].

He writes to one of the Govt. secretaries, 5-11-19 ; "I am really...so overpowered with...references, that it is impossible for mortal man to get thro'. ... There is a liberty assumed in some of the distant provinces that sets all rule and regularity at defiance, and I must ever regret that I cannot have time to submit it to...Government as I am so much interrupted by matters of detail [303-5].

"I have no less than 5 letters from the Civil Auditor pressing for what was never done before (certificates), 2 of them in one day, as if on purpose to annoy. It is impossible for mortal man to reply to all these"[4].

He writes to Mountford two weeks later, 21-11-19, "Pultah ; I am but just returned from Calcutta, which always costs me some days to replace my papers in order. ... My health is much better, but I am overloaded. I wish I had you, or the like of you (willing and candid and able) near me". Obviously Hyde was not his ideal ASG. [309].

26-11-19 ; "Permit me...to request you to purchase for me the new Almanac for the ensuing year the moment it is out, and sent it to me *on service ;* also the latest Madras Army List, as there are great changes by removals and casualties. ...

"While I am hurrying this off, I am annoyed by a sore leg, and obliged to get off to my couch. I was in town for a day on Saturday, and hurried off to receive some friends here—a member of Council and Sir Stamford Raffles just come in from Bencoolen [II,135 n.2, 427]—they left me this morning. I suspect the latter has his own troubles to get thro' from the differences with the Dutch and Penang Government[5]. ... All, great and low, have their troubles, and we little men should not complain if we have our share ; the only remedy is to move on in tranquility, guided by truth and integrity to the best of our judgement, and avoiding all intrigue and chicanery ; this will console and support us, let what will happen[6].

31-11-19 ; "Why don't you send me your printed catalogues of books ? I want rather old and curious books ; we get all the new ones from England".

19-2-20 ; "I am afraid for some time you have been too cautious, ... which, considering my state of health, was no doubt prudent, but had any accident occurred to me your private letters would be delivered to you, as they are docketed, and without reading. All my private letters to poor Riddell were in this manner, by his special desire, made up and sent to me in one parcel, and I even take pleasure in looking still at some of his. ...

"God bless you !—we leave Pulta in a few days, and if I can get extricated from a load of unpleasant matter, I shall avail myself of the Sandheads[7], perhaps, to go thoroughly into the Madras business, and also bring Captain Garling's representations forward, ... involving even your own appointment [318][8].

1-3-20 ; Calcutta ; "I came in here 3 days ago to despatch what we are sending in for the year [319], and I am worried to death, but your business will be taken in hand before I leave town".

21-3-20 ; "I have been laid on my back these 6 days by a tension & inflammation of the tendons of the right leg and thigh, which has now left me, excepting a slight tension of the ankle. The chief inconvenience was that for six days I have been prevented sitting at the desk to write"[9].

4-4-20 ; "Pulta. I am all in a hurry, leaving this place to go into our house to Calcutta, whither the ladies have gone in three days ago. Most of my papers are off, and I hope to be in myself after paying my respects to the Governor General tomorrow at Barrackpore[10]. It will be several days before I can get my books and papers arranged at Calcutta, where I shall endeavour to bring up some of the arrears".

7-4-20 ; "Pulta. I chiefly left my couch in order to apprize you that when I was in Calcutta lately I received your several packages".

P.S. "The above was wrote the day before I left Pulta, and I have been ever since so excessively employed in business, or harrassed by illness, or langour, that I could not write. ... My writing is so illegible that I now employ a writer to copy it off. Meantime I have had an immense load off my shoulders in the transmission of the several volumes and maps to Europe.

[1] A few miles above Barrackpore ; now site of pumping station and filters for Calcutta water supply. [2] DDn. 149 (80-5). [3] DDn. 149 (93). [4] DDn. 154 (111). [5] Stamford Raffles (1781-1826), under whom Mackenzie worked in Java [II, 425] ; for his difficulties with CD. *v.* Drewitt (124) & Das Gupta (145-9). [6] DDn. 154 (97). [7] at mouth of Hooghly. [8] DDn. 149 (111). [9] DDn. 156 (174). [10] The GG. had a country residence in what is now Barrackpore Park.

"I am going this day [9th May], to embark in a Pilot vessel for the Sandheads, and eventually for Jagahnaut [or Puri], if the season will permit our sailing. If so, I may stay there 20 days. ... This scheme has been in agitation for some time, but tho' medical men and my friends urged it ever since January, I could not agree till I could get many matters out of hand, that to leave undone would be inconvenient to individuals"[1].

He stayed at Puri more than 4 mo., and the change did him good; he was by no means idle, and kept in touch with survrs. in all parts of India. As usual, most of his corr. went to Mountford at Madras. 4-6-20; "Mallada, 7th coss north of Ganjam. ... We landed on the 22nd ultimo at Jaggernaut thro' a high surf, but more dangerous for want of good boats and boatmen than for its violence; at Madras it would be thought little of. Since that I have been journeying about along the coast, and find the benefit of this, and of the sea air and breeze, already, and hope...I shall return to Calcutta with renewed health. The business of the office...is carried on meantime by the assistant, Lieut. Hyde, but...for a month or so...direct all letters for me, official and private, at Jaggernath. ... I brought all your letters for a long time back with me, ... intending (if I can get the use of a bungalow there...) to be able to go into all arrears of office business in your quarter.

"My absence is with the entire concurrence of the Governor General thro' whose indulgence I was favoured with the use of the June pilot vessel".

At Puri Mackenzie was in touch with Buxton [432], who writes from Cuttack, 14-6-20; "I have a house and people here very much at your service. ... I am very glad you continue to derive benefit from the sea air and bathing, and as there are no such breezes to be inhaled in Calcutta...you would act wisely to prolong your visit. ... With regard to the best mode of returning, ... one of the vessels which trade to this place will furnish the best. ... When I left Cuttack last rains, I arrived at the vessel with all my baggage and servants in 24 hours, having taken a boat from hence, and sailed down with the current. ... Should you, however, prefer going by dawk, I can prepare a sketch of the routes, with their distances. ... Major Fraser[2] tells me he has sent off a palanquin for you, which I hope will get safe.

"I picked up several specimens of the different sorts of rock which compose the hills I have been up, and they are much at your service. They are not very remarkable"[3].

21-8-20; "I...with much pleasure accept your kind invitation to Pooree for a few days. Your journey to the southward will probably occupy you till the end of the week; therefore I propose being with you next Sunday morning, if that day will be convenient. ... I am much obliged by your kind offer of your bearers. ... I shall instruct the apprentices to repair to the place appointed, and survey to Bhobaneshur and the vicinity as you wish [17-9, 481].

22-9-20; "Anything that I can do for you in Cuttack, either in getting boats, shoes, or supplies of any kind, you will...acquaint me with. Wishing you a pleasant trip to Manickpatam, & happy riddance of the...accounts; and every benefit from the sea breeze and other luxuries of Pooree"[4].

To continue Mackenzie's letters to Mountford—14-6-20—"As I am here so much nearer to you, I will have your letters 4 days sooner for the time I remain, which may be a month, perhaps, in this vicinity, tho' not at this place. .. I suppose you will have Sir Thomas Munro with you soon [II, 433][5]. ... Baboo Row is a plague; he must have patience [391]. .. My agents are Messrs. Palmer & Co. [482].

15-8-20; "When I wrote...I was much hurried and distressed, and being obliged to go into my palanquin that evening of the 22nd, as my tents had been already sent off to Kinaruc, 20 miles"[6].

27-9-20; "Pooree. Permit me...to thank you for your several communications of the passing events, ... which have been more gratifying to me as I have had so little from others at Madras. ... I had to regret the failure of the house of De Fries[7], which I find every day affects...my Coromandel friends. ... The frequent deaths, also, have given me great concern in the loss of Dr. Stuart[8], Dr. Jebb[9], and very lately Mr. J. H. Travers, a much valued friend. ... I could wish to know some thing of the last two; I see a movement was proposed by Dr. Stuart's friends. I would willingly join in the contribution if not too late. ...

"Your account of the storm on the 10th May was interesting. ... I left Calcutta on 9th, and while we lay at Kedgeree till 14th, with what I considerd only a fresh breeze, we saw several vessels come in from sea that had suffered more or less damage. We, had, however, not an unpleasant passage tho' working to windward and tacking often till the 22nd May. ...

"I made some excursions to Cuttack, to the Chilka Lake, and thence to the Black Pagoda near this, but always quickly returned for the benefit of the sea air and sea bath, which has proved very beneficial. Some thought I should not have remained during the rains here, but the experiment shews how erroneous the idea was, as I have found it is dry during the rains, and all Calcutta recommended my not returning till their sickly season is past.

"I was down at the Carrons wreck about 22nd July, and saw the remains smashed into innumerable pieces. ... How she came there was the wonder, as their position the night before was estimated so far to the eastward of that place; the current probably had thrown them imperceptably out of their estimated course. I was absent at that time at a remarkable place, Bovan Iswar, on the 7th, but had an opportunity of seeing the sufferers, and among them an acquaintance. On my return 14 officers and 80 men were saved, and about 20 were lost, including the master and a sick Artillery officer.

"I was glad to find your house had escaped so well in the storm, as I understand mine did also. Some of the trees would, of course, suffer, but the remainder will probably flourish more next season, at least I found so in 1807. ...

"I observe the several changes and sudden appointments previous to the late change of Government. I dare say they were interesting enough to Mr. Elliott's friends[10]. ... I suppose he would have received the customary marks shown to him of respect at departure. ... The good people of Madras are seldom behind in their testimonies of regret on the departure of a tolerable Governor. If he has done justice to the interest of his employers and of the public, the dissatisfaction of obscure individuals will be of less import. I must own I did not expect to see your papers teeming with the usual adulatory compliments, but I felt disappointment in

[1] DDn. 149 (114). [2] Simon Fraser (1780-1845); BNI. 1799-1824 [371]; comdg. Cuttack Legion, 1817-22. [3] DDn. 147 (267-9, 282-6). [4] ib. (295). [5] as Governor, 1820-7. [6] ib. (127, 131). [7] Agents, Madras, John De Fries & Co. [8] Alex. Stuart, Asst. Surg. 1799; d., Madras, 11-2-20. [9] Richd. Jebb, LLD. advocate, High Court; d. Madras, 16-8-20, aged 38. [10] Rt. Hon. Hugh Elliot (1752-1830); Govr. Madras 1814-20; bro. of 1st Earl Minto; 3 unm. daus. at Madras; Emma, m. 1823, Gen. Sir Thos. Hislop; Harriet & Caroline, m., 1833 & 1835. Hugh Elliot bur. Westminster Abbey; *DNB.*; *DIB.*; Mrs. Elliot d. at Madras, Feb. 1819.

their absence. The Ball to the young ladies was very proper, and quite consistent with the wonted liberalitity of the settlement"[1].

Neither Mackenzie nor Riddell [qv], had been happy in their relations with the departing Governor, whose obstruction to Riddell's appt. [316, 497] had led Mackenzie to write, 21-3-17; "I think in your case the behaviour of some people has been shabby. ... What I think odd is that Cochrane[2] seems to avoid me on all occasions when we have met (which have indeed been rare), so that in passing in the same room one would almost think he was blind & had not seen me when I was on the point of speaking to him".

Mackenzie had been snubbed about a journey connected with his archæol. collns. [475]; "Under the unkind...treatment I met *in one superior quarter*, I did not like to commit myself to a man who could remark on my public exertions in the manner he did, & even to myself told me bluntly that my proposals were *for my own convenience*".

Again to Riddell in 1818; "Is your profound Chief to remain another year ? Or are you preparing your addresses of condolence for his departure ? God bless his departure; he can do me no more injury. ... You will have such oratory and such speeches when the Conquering Heroes return"[3].

He writes to Mountford from Dhâmra R., 28-10-20, on his way back to Calcutta, "I left Pooree on the 15th, and being disappointed of any other conveyance, I came down here the day before yesterday. I luckily found the Swift, a cutter of 40 tons, wherein I embark this evening. I have been terribly hurried for some time, and regret much that I have not a stay of a month longer at Pooree"[4].

To Buxton from Calcutta, 25-1-21; "I arrived here early in November after a quick passage and in good health, but unfortunately...a fever, and its consequences, ... have laid me up upon my couch almost ever since. I make use of another hand merely to account for my silence, and to acknowledge your several letters. ... I return you my best thanks for the drawings you sent me particularly that of the caverns. ... I am very thankful for any sketches that suit my purpose. ... I...enclose you a copy of the Canashoomazi—translated [from] the first part of the Khoordah—when I get the rest you will have the translation of it.

"As I dictate this from my couch, you will excuse me, as I have omitted several things. Have patience till I am well"[5].

In February he was so poorly that he asked permission to do his work from a *budgarow* on the river; "Shortly after my return hither on the 2nd November from the coast of Cuttack, where I had in some degree recovered my health, ... I was taken ill here, and...I was obliged...to remove to Budge Budge, 12 miles down the river, for a change of air, and for a temporary respite from close attention to the office. ... My medical adviser...has recommended my moving up and down the river for some time"[6]. ... He asked that "while in the vicinity of the river, and during convalescence" he should be allowed "the expence of hiring boats, budgerows, and occasional residence on the riverside, while thus employed on public duty". He was allowed the cost of his est. ... and for communicating with the office, but not his personal expenses[7].

He was constantly having to come up to the office to attend personally to calls for maps and infn. and writes privately, 11-3-21, "I was on the point of embarking on the river on Monday, before the receipt of your note with his Lordship's request, ... and tho' unable myself to sit up, or refer to papers, I have endeavoured to satisfy His Lordship's enquiry by direction to others.

"As I apprehend...that His Excellency is not aware of my present state of health...—that since the 29th January I have not been able to...go into the details of business—and have been repeatedly urged to go upon the river by my medical adviser—I have again applied for written opinion...to lay before His Excellency. ... For the last three days I could not sit up to dictate this, or direct the search of letters and papers"[8].

On 4th May, he was given formal permission "to proceed to the Sand Heads" and "to deliver over charge of your office to Lieutenant Colonel T. Wood ...until further orders"[9].

He died on 8th May on his way down the river.

In original will, sd. "on board H.M.'s Frigate LIDA, on coast of Java, 3rd August 1811" [II, 424], Mackenzie left one tenth of his property "to my servant Cavelly Venkata Lechmya, Bramin, and his younger brother Ramaswamy, ... in some compensation for the useful services of the said Lechmya and of his late brother C. Boria [II, 383-4 ; III, 464-5]. ... I desire that my brother, sister, and friends, recollecting the value I had for these persons, will by no means attempt to lessen or defeat my intention in this respect, which I wish them to consider sacred and inviolable [465]. ...

"To my faithful servant Lucius Rawdon Burke [312], star pagodas 1,000. ...

"Residue of estate to my brother Alexander Mackenzie[10], & my sister Mary Mackenzie [II, 349], half to each.

"Codicil, Calcutta, 18th Feb. 1815. My consequent marriage of course does away part of this will, but I now desire that after settling the sum of 40,000 rupees...on my dear wife, ... the residue to be disbursed, one half to my brother, one fourth to my sister, and one fourth to my wife; after deducting the percentage formerly allowed to my Bramin, Lechmyah, whose services are still valuable".

Codicil. Madras. 21st Jan. 1816. Besides the sum of 40,000 rupees settled on my dearly loved wife, ... the further sum of 20,000 be added to increase her annuity—that my brother Alexander have one half of the rest—...one quarter... to my sister Mary—that five per cent be paid to my faithful servant Lechmyah, Bramin, and all my native books & mss. ...

"Also twelve thousand rupees to my sister-in-law, Julia Bartells, the sister of my wife, in approbation of her good conduct and love to her sister".

A further codicil added in Bengal increased the sum settled on his wife, without stating the figures. It referred to an offer by the Directors to purchase the colln. It requested the executors not to forget "the pensioners at Stornoway, and particularly Mr. Robinson, Collector"[11].

Probate was granted to his widow on 22-5-21[12].

It is recorded that Mackenzie paid for the building of the Carn Ho. at Stornoway as residence for his sister Mary [I, 349], who became known as Mary Carn. Carn Ho., said to be of stern appearance, is now marked for demolition and replacement[13].

In 1948 the town council resolved to erect a memorial tablet and to honour the centenary of his birth by the pubn. of his biography [474].

Mackenzie was not happy in his work at Calcutta [301-5]. At the age of 64 he had lost the resilience with which he might a few years earlier have adapted himself to new surroundings and problems. No sick man can do himself justice, and there is great wisdom in the present-day rules for superannuation.

[1] DDn. 149 (146-50), 27-9-20. [2] who had first supported Riddell's appt. [3] DDn. 156 (114), 21-3-17; (161, 362), 17-4 & 16-7-18. [4] ib. (155). [5] DDn. 154 (123). [6] mc. 27-1-21. [7] DDn. 196 (3); 15-2-21; 191 (41-2); 16-2-21. [8] DDn. 154(125). [9] DDn. 191 (161). [10] Alex. d., Hastings, 15-9-16; *GM.* 86, Nov. 1816 (465); or 25-9-16, *Scots Mag.* 78 (879). [11] James Robertson (1755/6-1840), Collr. of Customs, Stornoway, a regular corr. whose g. son, Evander MacIver, writes of Mackenzie in *Memoirs of a Highland Gentleman* (198-200). [12] Ben. Wills 1821. [13] *Stornoway Gaz.*, 20-8-& 3-10-1948, for which I am indebted to Mr. W. C. Mackenzie.

He was a very great man; he had a sound knowledge of the fundamental principles of his profession, and a strong sense of the contribution that surveyors could render to the good administration and welfare of the country. He gave heart and soul to render this service as effective as possible. He was a great organizer, going meticulously into the smallest detail, without losing grip of main principles and objectives. He loved working to "a uniform system". It is obvious, however, that he was happiest when the stress of administrative duty was lightest, when he could devote time to his great hobby, the collection and elucidation of historical antiquities, some account of which is now given.

His kindness of heart and warm human sympathies—as well as his high principles of conduct and stern sense of discipline—are evident from the extracts that have been given from his voluminous correspondence.

The Mackenzie Collections

Detailed accounts of Mackenzie's collns. will be found in

Mackenzie Collection of Oriental Manuscripts, by H. H. Wilson; 2 vols.; Calcutta, 1828; 2nd edn., re-pub. by Higginbotham & Co., Madras, with bio. note, 1882.

The Mackenzie Collections by Blagden. London, 1816, pubd. as vol. I of *Catalogue of MSS. ... at India Office*.

Other accounts are given in *Asiatic Journal*, March 1822 (242); Aug. 1823 (137); April 1828 (483).

IHRC. XXVIII, 1951, I (147–52).

Alexander Johnston[1] [481] describes how Mackenzie came to take up this pursuit. Before he came to India he had been collecting infn. about Hindu knowledge, and he came out with introductions to Johnston's mother who had similar interests [I, 349]. "Wishing to have his assistance in arranging the materials which she had collected, she and my father invited him to...Madura early in 1783, and there introduced him to all the Brahmins and other literary natives who resided at that place. ... Mr. Mackenzie...soon discovered that the most valuable materials for a history of India might be collected, ... and during his residence at Madura first formed the plan of making that collection which afterwards became ...his pursuit for 38 years of his life, and which is now the most...valuable collection of historical documents relative to India that ever made by any individual".

In a letter written to Johnston, Madras, 1-2-17, Mackenzie says that "it was only after my return from the expedition to Ceylon in 1796 [I, 117] that accident...threw in my way those means that I have since unceasingly pursued, ... of penetrating beyond the common surface of the antiquities, the history and the institutions of the South of India. The connection then formed with [Kavali Venkata Boriah, II, 338–4]...a Bramin, was the first step. ... Devoid of any knowledge of the languages myself, I owe to the happy genius of this individual...the means of obtaining what I so long sought. ... On the reduction of Seringapatam in 1799 not one of our people could translate from the Canarese alone. At present we have these translations made, not only from the modern characters, but the more obscure and obsolete. ... From the moment the talents of the lamented Boria were applied, a new avenue to Hindu knowledge was opened, and, though I was deprived of him at an early age, his example and instructions were...happily followed up[2].

In 1797 the Directors had called on all Presidencies to collect material for compilation of "a general history of the British affairs in the East Indies." Govt. servants should "be instructed to transmit... such information on the Chronology, Geography, Government, Laws, ... the Arts, Manufactures, and Sciences, ... as they may...be able to collect".

Six years later they complained that "no information whatever" had been received from Madras, and pressed that "the most effectual measures may be taken" [II, 111], and the Madras Govt., 7-1-04, called on Mackenzie to assist[3]. The Directors so appreciated his contributions that they endorsed the orders exempting "from payment of postage all letters and packets despatched or received by Major Mackenzie on the History and Antiquities of India"[4]. On the other hand, Mackenzie constantly reiterates that "all the purchases have been entirely at my private expence".

His researches, stimulated by his long connection with Mysore, were warmly appreciated. Mark Wilks[5] writes 4-3-07; "Everything...most interesting...in general history may be traced...by the laborious process to which Major Mackenzie has devoted his leisure, which he has been able to snatch from...active and distinguished public service. ... Digesting the results may fairly be considered a national object. ... The facility which Major Mackenzie has acquired in directing...a large establishment, ... and in seizing at once what is useful in the materials which they collect, is the result of long experience. The path is untrodden, and it has...too many discouragements to be trodden by another. The object will be accomplished by him, or it will probably never be accomplished[6]".

This was endorsed by Bentinck, who writes; "His ardor, perseverance, and contempt of all climate and danger in the pursuit of this object have been quite extraordinary. No man that ever was in India has had the same opportunity, has incurred the same expence, or devoted the same time to there investigations. If it is possible...to clear away the impenetrable darkness with which this Indian system, its origin, and its progress, has been involved, the efforts of Major Mackenzie promise the fairest hopes of success"[7].

By his own account Mackenzie had by this time expended many thousands of *pagodas* on these collns., and to compensate him and give further opportunity for reasearch, he was given the sinecure appt. of Bkmr., Mysore [II, 423; III, 474]. The Directors further awarded him 9,000 *ps.*, admitting "that his merits have not been merely confined to the duties of a geographical surveyor. ... Lieut. Colonel Mackenzie should himself digest...the materials he has collected; and we hope the office which you have conferred on him in Mysore will afford him leisure for this work. After he has accomplished it, the original materials are to be transmitted to us, to be deposited in our Oriental Museum.

"In the meantime, we wish to indemnify him for the disbursements he has made in procuring this collection, ... trusting that it will not amount to any large sum, and we desire that he will state to us

[1] (1775–1849); Son of Samuel and Hester Johnston; Barr.; CJ. Ceylon 1805–19; HC. Reports, 1831–2, vol. IX (254). [2] *JRAs. Soc.*, I., os. 1831 (333); Wilson, H. H., I (ii–iii). [3] CD. to M. 9-5-1797 (73) & 6-7-03 (3–4). [4] DDn. 83, 28-4-04; CD to M. 23-10-05; MPC. 17-2-09; DDn. 68 (145–6). [5] (1760 ?–1831) Mad. Inf.; *DNB*. Bkmr. Mysore, offg. Resdt. [6] MPC. 323/1807 (1459–61) 13-3-07. [7] Govr.'s minute of 8-3-07.

an account of it; which, from his character we are persuaded will be correctly done"[1].

The colln. was by no means confined to MSS. and copies of inscriptions, and in 1808 Mackenzie reported a Jain statue "of which I considered the preservation might be desirable, as illustrative of the religion & literature of a remarkable sect...hitherto little noticed by Europeans. ... I have...shipped it, by an order of the Board of Trade, on board the Hon. Company's Ship the Phœnix, carefully packed up in a box; ... such specimens of the arts are rarely met in India unmutilated or defaced, & this subject is in perfect preservation"[2].

Whilst his collrs. and interpreters [II, 356; III, 391] continued work in S. India, he himself extended colln. in Java between 1811 and 1813, and in the Upper Provs. of Bengal during 1814. Though his official Java est. had to be closed down from 1-5-15, he still maintained "a Dutch Translator and Native of Java" at Govt. cost[3] [II, 437; III, 391].

He regretted that several of his best workers were unwilling to accompany him to Bengal in 1817. Some were found work in Madras, and others marched by the coast route under ch. of Lakshmaiah, who, since Boriah's death in 1803, had been his hd. intpr.; "Letchmiah has been desired to prosecute during his journey the various historical researches of which he has so long had the chief management, and...I trust it may be deemed proper to allow him, after he passes Masulipatam, a small guard of sepoys for the protection of those valuable articles"[4] [311].

Mackenzie was greatly relieved at their arrival, and writes to Riddell, 8-5-18; "Lecchmyah arrived...with all his people safe & well, tho' some of them had been dangerously ill. I am exceedingly obliged to all my friends on the Madras & Bengal Establishment, ... as they have, in consequence of the passport you gave them, ... been handed along safe from one Judge & Magistrate to each other & supplied with cash. ... The poor man has done his duty, as I ever expected, & excited some very handsome compliments from some of the gentlemen to whom I was a stranger"[5] [465].

His collectors even travelled so far as Poona, and he writes to Elphinstone from Calcutta, 7-9-18; "My whole establishment...has been almost overturned by my removal here. I had some of them down to Poonah and Ahmednugger in 1806-7 & 8, whence I derived a body of very interesting information. ... I recalled them as I found the expense beyond my limits, and I had thoughts in 1810 of going to Europe. In 1815 I was induced to send some of these "explorations" again into the Nizam's country, and the hilly country bordering on our Circars, whence I have obtained a very curious body of materials on the ancient history of the Canarese, Maratta, and Worongole empires, supported by MSS. and inscriptions. I withdrew them again last year, except one who is still near Gulbarga. ...

"When your leisure permits, I have much to solicit on the early history of the Mrashtra nation and its 96 tribes—of the Arab Colony, and singular Government that existed formerly near Poonah—of the caverns and sculptured excavations in different parts of the western country, some near Vengurla, some towards Guzerat"[6].

He writes to a friend in Sambalpur, 20-8-18 & 26-3-19; "I am desirous of getting...an account of the languages & customs of the several hill tribes that live in these wild tracts. They seem to me to be the remains of the original indigenous race from Cape Comorin to the Ganges & even further. A comparison of their several languages &c., would best explain this. ... A vocabulary of the languages would be curious & useful"[7].

In Sept. 1820, whilst at Puri visited the Buddhist ruins at Bhobāneser and Udayagiri with the Collr., having facsimiles of inscriptions and sketches made by Buxton's appces. [478][8].

Wrote to Mountford, 23-2-19, thanking him for drawings from Guntur; and asking for "some account...of the antiquities at Amrisweram, or such others as you might have observed. ... I have been collecting information from all sides. Do not let your modesty or timidity stand in your way. Your communications to me will be received with any degree of reserve you wish, tho' I would rather recommend you should make them a part of your memoirs [488]. It was a pity the whole of these vestiges of antiquity were removed from Amrisweram to a situation where, in all probability, they will be lost. I wish I had taken...advice...in 1817...to apply for the protection of Government to save them from destruction. But I had no suspicion then that they would be transported bodily"[9].

Again to Mountford 27-9-20; "I shall be glad to hear of the progress of your Literary Institution[10] [392]. I have been rather disappointed in not getting any return to the numerous memoranda I circulated about antiquities, particularly the curious funeral monuments I first discovered under the Presidency. ... From Guzerat, Malwa, Bilsa, the Nerbudda, and Java, I continue to receive very satisfactory drawings and memoranda of what I pointed out. From the Coast, excepting your own sketch from Guntoor, I have got nothing beyond what the maps of the surveys give.

"I was rather disappointed from Mr. B—, to whom I gave every information on these subjects, and...the ancient characters, and sent my old Jain with him to Mavellipooram [475 n.1] to assist his attempts to decypher. His cousin, Mr. B— of Malabar, in place of assisting my enquiries, converted my hints to his own purpose, and even communicated to the Editor of the Calcutta Journal what I could have given. ... Now, it is not usual among literary men to encroach on what is already traced out by others; it is rather usual to assist each other. This was the method that poor Ellis and I followed for years[11]. ...

"I am only afraid that your institutions are too numerous for Madras and that, however ardent at first, and ready as to pecuniary supplies, you cannot be supported in other respects without a new generation of ardent spirits are reared"[12].

In Dec. 1816 he was cheered by a visit from his old friend Alexander Johnston [I, 349 n.5; III, 480 n.1], who told the House of Commons 15 years later that, "being myself about to return to England from Ceylon, I went to Madras to take leave of him previous to my departure [475]. ... He, in consequence of...his belief that we should not meet again, addressed a letter to me giving me a detailed account of all his literary labours in India, and requested me, in case of his death, to publish it.

"On my arrival in England, I explained to Mr. Grant[13], the former Chairman of the Court of Directors, the great advantage it would secure for oriental history and literature were Colonel Mackenzie to be allowed...to come to England upon leave, in order that he might...arrange this valuable collection. ... Mr. Grant...agreed...to give the Colonel leave...on his full pay and allowances for three years. No steps were however taken...because...of the Colonel's death in Bengal"[14].

[1] CD to M. 9-2-10 (5-8); MPC. 13-7-10. [2] DDn. 43 (262), 24-10-08. [3] MMC. 26-7-17. [4] from Riddell 5-8-17; MPC. 7-10-17. [5] DDn. 156 (344). [6] DDn. 154 (7-10). [7] DDn. 156 (141, 152). [8] Udayagiri, one of 4 low hills about 25 m. NE. of Cuttack, and 5 m. W. of Bhuddhist ruins of Bhobāneser, Jājpur [000]; Stirling (151); *Imp Gaz.* XXIV (109). [9] DDn. 149 (48). [10] The Madras Literary Soc.; still in existence, with most interesting lib. of old books. [11] Francis Whyte Ellis (1777-1819) Collr., Madras, 1810; Tamil & Sanskrit scholar; d. Rāmnād, 10-3-19, aged 40; *DNB.*; *DIB.* [12] DDn. 149 (146-50). [13] Chas. Grant (1746-1823); Chmn. CD., EIC., from 1805; *DNB.* [14] HC. Reports; cf. Sandes, II (265); Mackenzie (194-5),

Mackenzie had himself ventured to write direct to Grant from Madras, 7-7-15, drawing his attention to his researches and collns. He had just returned after 4 years absence and had sensed the Madras Govr.'s lack of sympathy [478–9]; "On my arrival here, I have found such an entire change of men in office, that I feel myself precluded from the same frank communication that was formerly received with complaisance at least"[1].

After Mackenzie's death Hodgson was left with the staff of translators and writers employed on the colln., and an immense store of specimens and papers which had really nothing to do with the duties of SG. At his suggestion Govt. first ordered that these persons "should...complete the catalogue and analysis of the various Manuscripts, Inscriptions, and Grants, collected by Colonel Mackenzie in the Deccan, ... in which they are...at present engaged. ... [They] can conveniently remain in the apartments at present allotted to them until their work be completed. ... His Lordship in Council...relieve you from any further charge of them. It will be necessary...to afford the services of your Register, who has been employed in the preparation of the catalogues and translations, to assist...when he can be spared. ... You will also continue to draw...the salaries...distinct from that of the Surveyor General's Office[2].

By Oct. 1821, Hodgson found that the work was progressing so slowly, without any real supervision, that he obtained authority discharge the staff and hand over the material to Dr. Horace Wilson [312, 391–2].

Rawdon Burke, the Registrar [312, 479], knew little about them; "All articles considered by [Mackenzie] to be his private property were locked up when he left Calcutta to go on the river, ... with directions to me not to allow access to any person whatever. ...

"After his death, his friends and Agents called at the house, and sealed the doors of the rooms containing the above-mentioned property. A few...maps that I pointed out as public property were, with the concurrence of those gentlemen, brought by me into the office below, and the rooms remained sealed until the 25th or 26th May, ... when the Executrix [Mrs. Mackenzie] attended...to examine the papers, and remove the property to another house.

"Several materials that related to the antiquarian department were delivered to me by C. V. Letchmyah, Bramin, but most of the portfolios of drawings of sculptures and other relics of antiquity, together with the volumes containing drawings of the costumes of the natives, of animals, reptiles, etc., ... were removed to the house of the executrix. ...

"I believe it was the intention of the late Colonel Mackenzie to illustrate his historical collections with maps and plans, but I am not aware that he had...commenced upon them"[3].

Blagden divides the colln. into three sections[4]; *1822 collection*; being books collected at Govt. expense, and considered public property; tr. to Govt. by Mackenzie's Agents, Palmer & Co., Calcutta, under letter of 10-8-21. Sent to England at once, and reached India Ho. 27-4-22.

Private Collection; offered to Govt. by Mrs. Mackenzie in Calcutta; after examination by a com., 160 vols. out of 212 purchased for Rs. 2300, sent to London, and placed in EIC. lib., 1823.

Both these deal almost entirely with Java and NEI.

Main Collection; examined by Dr. Wilson in Calcutta, and covered by his descriptive *Catalogue*, pub. by Govt. in 2 vols., Calcutta, 1828[5]. Abstracts of his reports are pub. in *JASB.* VIII, 1838 (400–14, 469–521).

Of this colln. everything appertaining to S. India was moved to Madras Coll. Library, 1828. In letter, 9-3-30, Lakshmaiah asked Madras Govt. to tr. it to Mad. Lit. Soc., where he did some work on it, but funds for further fd. research were not granted [465].

On his initiative, and with the recdn. of ASB., the Rev. Wm. Taylor, a missionary working in Madras, and "an able and zealous expositor", was invited to make a digest of the MSS., which appeared in the *Madras Journal of Literature and Science*, and was reproduced in *JASB.* of 1838[6] [507].

Later again Taylor prepared a *Catalogue Raisonnée of Oriental Manuscripts in the Madras College*, which included mss. collected by John Leyden [II, 416], and was pub., Madras, 3 vols. 1857–62.

The colln. was re-tr. to the Govt. Oriental MSS. Lib., and is now housed, about 8000 vols., in Connemara Lib. Madras.

The remainder of this MAIN colln., is held at IO. [CRO], London, and has been described by Capt. Harkness, Sec. of the R As Soc., and later by Blagden [480].

Mackenzie claimed that he had spent at least £15,000 or a *lakh* of rupees of his private money on these collns., towards which the Directors had paid him a gratuity of 9,000 ps., or about £1,500 in 1810, and another Rs. 12,000 in 1821. His Agents, Messrs. Palmer & Co., now "Attornies to the Executrix", claimed on behalf of the estate a further sum of one *lakh* of rupees for the Main Collection, and submitted "an abstract account of the expence incurred by the late Colonel Mackenzie, ... supported by twenty-six detailed statements exhibiting a total of sicca rupees 61,452-6-11. ... They had not introduced any item that did not appear as an actual disbursement in Colonel Mackenzie's...memoranda, which, however, ... were in considerable confusion. ... There could be no doubt that the aggregate then exhibited fell very short of the actual sum which had been expended. ...

"Messrs. Palmer & Co. further remarked that to severe indisposition during the latter part of Colonel Mackenzie's life, and much time occupied in actual service—added to the total disregard of his private pecuniary concerns which was a leading feature of his character—was to be attributed a remissness by which his fortune had already been injured, and his estate...would suffer considerably. ...

"With regard to the coins, drawings, images, minerals, &c., ... the account...was so scanty and meagre that scarcely one twentieth part of the sums expended upon them were noted down. As this branch of the collections...was distinct from the line in which encouragement had been held out...in your Honourable Court's Letter...dated the 9th February 1810 [II, 421 n.6, 424 n.4; III, 480], Messrs. Palmer & Co. communicated the wish of the Executrix to leave it to the pleasure of Government to accept or reject".

Wilson himself "entertained no doubt...that they had cost fully a lack of rupees; but how far they might be worth that sum was a question on which Mr. Wilson declined to offer any opinion, observing that the value of the articles...depended altogether on individual prepossessions".

The Bengal Govt. was satisfied, and paid 1,00,000 rupees to Palmer & Co. "on their engaging to refund the whole or any part of it in the event of the Honourable Court declining

[1] Letter preserved in Town Hall, Stornoway. [2] BGC. 22-6-21; DDn. 191 (217). [3] DDn. 198 (84-6), 29-5-22. [4] Blagden (vii). [5] Wilson, H.H. [II, xxviii]. [6] MPC. 18-10-36 (23-4), 18-4-37 (81-2) 9-6-37 (14-5); *JASB.* V, 1835 (511-3 VII, 1838 (105-31; 173-92; 372-414); Mad. JLS. contains papers by Taylor, *v.* IV (139, 146); VI (17, 142); VIII (1); IX (1); X (1, 388); XI (86); XV (173); XVI (33, 55, 102); Series 2, VI (67, 94), and a *Report on the Elliot Marbles.*

to confirm this arrangement"[1]. They despatched the colln., part to Madras, and part to London.

The Directors were indignant, but felt they could not repudiate the transaction; "The step...which the Government so imprudently took of forwarding a part of the collections to this country...left us scarcely any other alternative but that of confirming the purchase. ... We strongly disapprove of the...disbursing so large a sum for such a purpose without our previous sanction. ...

"The only part of Colonel Mackenzie's researches for... which any prospect of indemnification had been held out by us during his life was the statistical and historical part. ... But we entertain strong doubts whether the whole mass is worth the large sum of a lac of rupees, in addition to the twelve thousand rupees advanced to Colonel Mackenzie, and the considerable sums which have been expended since the purchase. ...

"It appears from a private letter addressed...to our Librarian...that the opinion which Mr. Wilson at first entertained of the value of the collections has been materially lowered on a more minute examination of them. And the character of that portion which has been received in this country does not lead us to form any very favourable opinion of the value of the remainder"[2].

Whatever may have been the actual cost of collection, or the market value at the time, Mackenzie has preserved for countless students of history an immense mass of interesting and valuable material, which otherwise would surely have perished. It is doubtful, however, whether his enthusiasm for collecting was tempered with sufficient discrimination, or whether he could have dealt with very much of it even had he lived to examined it more thoroughly himself. Markham records that it contained "3,000...tenures inscribed on stone or copper—8,076 inscriptions—2,630 drawings—78 plans—6,218 coins —and 106 images".

It was to enquire into the best way of utilizing these collns., and possibly extending them, that Sir Alex. Johnston was examined before a Comm. of the House of Commons in 1831 [481]. He urged that research should be extended through the agency of the R As Soc.[3]; "The Colonel, had he survived, intended to have added to his collection a great mass of materials connected with the history of India, which are still to be found in different parts of the country, but which, if measures be not speedily adopted to collect and preserve them, will be altogether destroyed".

Now in 1952, the Govt. of Madras, under the auspices of the India Historical Research Comm., has opened a special section to repair the Mackenzie MSS. and to micro-film those that are beyond repair. The Madras University also is preparing a summary of the MSS. in the four S. India languages, Tamil, Telegu, Kannada, and Malayalam[4].

Appealing to a different interest altogether are the Mack. MSS. at IO Lib. in vols. which contain interesting matter such as corr. books of the CE.'s Madras for about fifty years, which have been freely quoted in vols. I & II of these *Records*[5].

Amongst the few pub. papers or notes left by Mackenzie are *Life of Hyder Ali*, pub. *As AR.* VI., 1804, "from a paper found in 1787 in the Paymaster's office at Nellore". *Account of the Jains* "collected from a Priest...at Mudgeri", and tr. by Kavali Boriah, and *Description of a Jain Temple near Calyani*, Feb. 1797, pub. *As R.*, IX., 1807 (2, 44, 272).

He also contributed to Dalrymple's *Oriental Repertory* [I, xix] and other periodicals. Perhaps the most interesting of all was a paper submitted at a meeting of ASB., 5–4–15[6] just after his return to Madras, entitled; "View of the principal Political Events that occurred in the Carnatic, from the dissolution of the ancient Hindu Government in 1564, till the Mogul Government was established in 1687 on the conquest of the capitals of Beejapoor and Golconda. Compiled from various Authentic Memoirs and Original MSS., collected within the last ten years". This had been translated from a Marātha ms. by Boriah, and closely edited by Mackenzie. His explanatory footnotes indicate the wide extent of his erudition, and the manner in which he might have dealt with other parts of his collns., had he the leisure. The following are amongst his personal touches;

"Armigam is situated near Durajapatam on the Coast, 60 m. north of Madras. I had an opportunity of seeing these remains in 1796".

"Travelling by accident by Nagulvansa, not far from Cummamett, in the Nizam's Dominions, in 1797, a part of the country overrun with jungle, and shewing evident vestiges of better times, I accidently met with a Dutch tombstone, which led to the discovery of the riches of their factory."

"The remains of Beejanuggur were minutely examined in December 1800" [II, 153].

MACLEOD, John [II, 428]. Bo. Engrs.
bapt. 8–7–1794. d. Bushire, 20–9–23; MI. at Armenian ch.

Ens. 25–10–11; Lieut. 26–1–19.

Son of Rev. Roderick Macleod, DD., Principal of King's Coll., Aberdeen, and Isabella Christie his wife.

1813–5, dmn. and survr. on rev. svy., Bombay and Salsette Is. [II, 187].

BO GO. 4–4–16, to join Johnson on svy. of passes into Deccan; continued svy. till 21–8–16; then Asst. to Comnr. in Deccan [83, 122, 464].

MALCOLM, John. Mad. Inf.
b. 2–5–1769. d. of paralysis, 30–5–33.

Ens. 24–10–1781 ... M Gen. 12–8–19.
Govr. Bombay, 1828–30 [132].

m., 4–6–07 Isabella Charlotte, 2nd dau. of Sir Alex. Campbell (1760–1824), C-in-C. Madras 1821–4; she d., Bath, 26–6–67; her younger sister m. John Macdonald [II, 418].

KCB. 1815; GCB.; KLS. [443 n.12] auth of *Political History of India*, 1811; *Report on the Province of Malwa*, 1821, pub. 1827; *History of Persia*, 2 vols. with map, 1815; *Administration of India*, 1833; *Life of Clive*, 1836.

DNB.; *DIB.*; *EIMC. I*; *Geo Mag.* I, 1871 (301); Kaye; Portrait by Geo. Hayter, 1815, Foster (74), VM. Exbt. (1126, 1244); statue, Westminister Abbey.

Not a survr., but had keen appreciation of svys. and maps; initiated svys. of Gujarāt & Persia, and maps of Persia and Mālwa.

1782, arrd. India; 1798, Persian Intrpr. with force that disbanded French corps at Hyderābād [I, 117, 175].

1799–1801, in ch. 1st mission to Persia, taking Webbe and Pope as survrs. [I, 286, 375; II, 173; III, vii]—1803–6, Marātha War, on pol. duty with Grand Army—1808–9, abortive mission to Persia—emp. Mad. survrs. constructing map of Persia at Bombay [II, 131, 174; III, 337]—sympathised with officers in Mad. mutiny [II, 174, 313–4; III, 331].

[1] B to CD., Gen., 1–1–23 (117–26). [2] CD to B. 28–2–27 (2–8). [3] cf. *JR As. Soc.* I (165). [4] Tamil Section pub. Madras, 1952. [5] Mack MSS. [I, xvi; II, xxv]. [6] *JASB.* XIII, 1844 (421–63; 578–609).

1809–10—initiated Williams' svy. of Gujarāt [II, 170–3]; sent survrs. to Baluchistān, Persia and Baghdād, and himself led successful mission to Persia [II, 174–5]—on return retained Webbe for construction of map of Persia [II, 176].

1817–8, Marātha War; 1st Aug., 1817, left Hyderābād on horseback and—riding horses of Marātha escort—did 164 m. the last 3 days—64 in the last 8 hours—to join Elphinstone at Poona[1] [427, 473, 475]. Besides leading operations with rank of Brig. Gen., held pol. ch. of Mālwa to 1820, empg. several officers on svy., and Webbe on map of Mālwa [84–6, 267, 382–3, 436, 441]. *Report on...Malwa* (463–80), his instns. to assts. prescribed utmost consideration towards inhabitants.

1822, to England; 1831–2, MP. for Launceston.

MALLOCK, Samuel. Ben. Engrs.
b. 1–11–06. d. unm., 24–12–33[2], at sea, on voyage home.

Ens. 18–12–23; Lieut. 28–2–25; furl. on mc. 24–10–33.

Son of Rev. Roger Mallock, of Cockington Court, Devon, and Mary his wife, dau. of Dr. John Mudge, *DNB.*, and sister of Adm. Zachary Mudge (1770–1852), *DNB.*, RN.

Hodson, III (216).

Arrd. India 7–5–25; BGO. 14–6–25, to officiate as Adjt. of Engrs. Ft. Wm.; 18–11–26, appd. Survr. to Sundarbans Comnrs. [7, 141]; Oct. 1827, appd. Ex. Engr. PWD. Purnea. *Ben. Regr.* 94 (257), svy. of Dum Dum cant. Aug. 1833.

MANSON, James. Ben. Inf.
b. 16–7–1791. d. 15–7–62.

Ens. 14–9–08 ... Lt.-Col. 24–4–47; furl. on mc. 21–2–52; M Gen. 15–5–59.

Son of Thomas Manson and Susan Black his wife; his sister (?) Mary m. James Herbert [457], and his dau. Charlotte m. Geo. Logan of GTS.

m., before 1820, Henrietta—

Hodson, III (221–2).

BGO. 21–2–17, to supd. building of Circuit Ho. etc., at Mirzāpur; ib. 28–12–18, furl. to Europe, on mc.

ib. 3–7–23, appd. asst. to Herbert on geol. svy. of Himālāya Mts. [268].

JASB. XI, 1842 (1157–82) gives Manson's journal, Sept.–Oct. 1827, of a "visit to Melun and the Oonta Dhoora Pass" in NW. Kumaun, accd. by Herbert and 2 other officers [269]. At halt on 25th Sept. Manson had "a lesson from Herbert in the use of the theodolite". This journal was ed. by Batten, who comments; "The writers and editors of such papers, tho' they may lay no claim to scientific qualifications (so difficult to acquire in India) are nevertheless...rendering...the important service of *pioneering*".

On close of svy. in 1828 appd. acting comdt. of Kumaun Local Batt.; 1831–51, Comnr. with Baji Rao, ex-Peshwa, at Bithūr, 10 m. N. of Cawnpore.

MAT(T)HEW(S), Paulet. Rev. Survr., uncov.
b. 1807/8. d., Jamalpur, 16–7–32[3]; MI.

Son of P. Mat(t)hew(s), indigo planter, Chiekrah.

m., St. John's Cath., Calcutta, 8–3–24, Miss Anne Verboon.

13–12–24, reported by Fisher as employed in Pol. Dept. exploring towards Manipur; "50 men from Rajah Gumbeer Sing's Infantry, directed to escort Mr. Mathews on the route to Munnipore, reached Buskandee on 2nd. inst., and proceeded with that gentleman to...near Luckypore, proceeding forward on 6th inst." Again, 19–12–24, Mathews "returned this afternoon, having penetrated to within 3 days journey of Munnipore", and again, 28th, Mathews had returned "with memoranda and observations. His route appears to be impracticable for troops"[4].

1825, on svy. under David Scott, AGG.; survd. Dhansiri R. [53–4]; *Govt. Gaz.* 2–6–25, letter from Rangpur, 19–4–25, tells of escort of 1 NO. and 30 men with "Mr. Matthews, a surveyor in Mr. Scott's Department, to explore the road", five days journey Rangpur to "Bor Haut".

1827–8, on rev. svy. in lower Assam under Bedingfield, holding ch. from latter's death in 1829 [146, 390, 423, 501] till his own, having "arrived at Jamaulpore on the previous day in a hopeless state".

MATHIAS, Vincent. Mad. Inf.
b. 18–4–1793. d. 12–1–67.

Ens. 24–8–11 ... Lt.-Col. 23–12–38; ret. 23–6–41; Hon. Col. 28–11–54.

Son of James Mathias, of Stanhoe, Norfolk.

m., 1st., Llambeblig, Wales, 9–10–32, Elizabeth, dau. of Richd. Poole, surg. of Bangor; she d. 30–12–37, on voyage home.

m., 2nd., Cuttack, 9–7–39, Mary Anne Louise, dau. of J. Spencer.

Ens. w. Regt., Norfolk Militia, 27–5–09.

July 1815, MMI., cl. IX [II, 321].

1819–20, as AQMG., on svy. under Malcolm in Mālwa; MRIO. 187 (36), svy. of Mhow cant., and surroundings; 26–3–20, "left Mundleysir in an open boat...down part of the Nerbudda as far as Broach, to ascertain the practicability... of navigating it" [84, 123].

MAY, John Stuart. Civ. Survr., uncov.

Dmn. SGO. Calcutta, 1–1–19; survr. Mātābhānga R. June 1820; Supdt. Nadia Rivers, 1825; resd. Aug. 1840.

DDn. 154 (45), 19–12–18, SG. writes to Mil. Sec., Col. Jas. Young, who had introduced May; "He seems to be the real stuff from which we might make a good surveyor; he is not immediately up to geographical survey in all its branches, but with his fund of elementary knowledge, his practice of land surveying & mode of drawing, I have no objection to take him in tow on such terms as I have mentioned to him" [312]. Again, 9–8–19; "In reply to your note about Mr. May. He is a deserving young man, & you need not be uneasy for him with me; at the same time that I approve highly of your & his friends endeavouring to get him introduced into the service as a cadet".

1820, resd., and appd., June, to maintenance of Mātābhānga R. [15, 313]; from 1825, Supdt. of Nadia Rivers, "with a view to keeping them open for navigation" [16]. Amongst his many maps was one "of the Nuddea Rivers with Ganges from Furruckabad to Gwalparah, & Hooghly from Sook Saugor to Nuddea[5]".

1831–2, survd. Rājmahāl Hills to investigate catchment areas affecting floods caused by unusual heavy rains[6].

1839–40, on sick leave during cold weather and resd. on acct. ill-health.

MELVILL, Peter Melvill. Bo. Inf.
b. 2–7–03. d. 4–11–95.

Lieut. 22–11–19 ... Col. 28–11–54; ret. as Hon. M Gen. 31–12–61.

Son of Philip Melvill, of Pendennis Castle, Cornwall.

m., Bombay, 14–1–36, Catharine Mary, dau., of John Robertson, of Tweedmouth.

KCB.; *DIB.*

BO GO. 1–11–20, appd. Asst. Survr., Gujarāt Rev. Svy., remaining with svy. till 1827 [170 n.5]; Bo R As Soc. II (276), *Notes on Agriculture...Gujerat.*

1838, PA. Cutch; 1840–59, Sec. to Bo. Govt. in Mil. Dept.

[1] Kaye, II (157, 166). [2] Conolly gives 20–12–33. [3] on Brahmaputra about 30 m. above Mymensingh. [4] HMS. 665 (141, 155); cf. *Govt. Gaz.*, 24–1–25, letter from Dacca. [5] *Ben Regr.* 46 (189). [6] *Ben Sel.* II, 1851.

MITCHELL, Hugh. Mad. Inf.
b. 24-11-1789. d. 21-3-60.

Ens. 16-3-11 ... Lt Col. 19-11-39; ret. 31-10-41; Hon. Col. 1854.

Son of Thomas Mitchell and Margaret Taylor his wife.

m., London, 25-2-35, Jessie, dau. of Sir John McCaskill.

1816-8, with Hyderābād Subsy. Force; on svy. of passes [83, 214]; with Malcolm in Mālwa, drawing svy. allces. as AQMG. 24-3-to 20-8-18; "I was employed in the first instance on a survey in Western Malwa. After my return...I was constantly employed in preparing the materials from which the map was compiled, by protracting the surveys, and in constructing the map from them"[1] [83].

MOHSIN HUSSAIN, Syed Mir.
Inst. Repairer. b. Arcot.

"A Muhomedan by religion, but not a bigot; a natural born subject of Her Majesty, his place of birth being the vicinity of Madras. By descent he is partly Arab. ... He came round originally to Calcutta with the late Colonel Blacker, and was brought up in the shop of Mr. Gordon, a jeweller of some eminence in Madras [258 n.2], where the Colonel first met him, and was struck by his uncommon intelligence and acuteness"[2].

Blacker had employed him first in the office of the QMG., Madras from 1819, "to repair instruments", but "he was not a public servant"[3]. After appt. as SG. in 1823, Blacker called Mohsin Hussain up to Calcutta, and appd. him on Rs. 25 pm. in place of the local *sicligar* [I, 290 n.6; III, 214, 313]. Hodgson taught him to take astr. obsns., and found him "a most respectable man and steady observer"[4] [188].

From 1830, his talent and ability won the confidence of Everest, who had him appd. Math. Inst. Maker in 1842[5].

MONTGOMERIE, Duncan [II, 430].
Mad. Cav. b. 30-7-1789. d. 20-4-78.

Corn. 1-6-10 ... Maj. 17-8-38; ret. 16-3-40; Hon. Lt Col. 28-11-54.

Son of Duncan Montgomerie, of co. Fife.

m., Madras, 17-1-25, Harriet Isabella Katharine, dau. of late M Gen. J. Durand, Mad. Est.

Oriental Club.

March 1810, MMI., cl. v [II, 320]; on completion of course, employed in reducing the svys. to form a 1-inch map [II, 319].

1815-6, with Hyderābād Subsy. Force; employed on svy. of passes "within the Nagpore Territory, to the east of the Warda" [83-4, 331]; 1817-8, Marātha War, with fd. force, Dhārwār.

Strongly recdd. for svy. employment by Mackenzie, who writes to Elphinstone at Poona, 7-9-18, that he "stands on my books for employment on account of great satisfaction he gave in reducing the whole surveys of our Military Institution in concert with another officer [Mountford, 488], already provided for on the survey. The beautiful and satisfactory specimen of Mr. Montgomery's drawings [II, pl. 12; III, 95, pl. 11], and his character, induce me to recommend him also to your notice for employment. He is now with regiment at Ellore, and I write his Colonel of this date, ... who is much interested in him. ... The specimens of his drawing in maps are indeed beautiful"[6] [339-40].

MGO. 2-2-19; "placed at disposal of Commissioner at Poona, to be employed in the Surveying Department in the Deckan. At present doing duty with 1st Native Cavalry at Arnee". On svy. of S. Marātha Country [125 n.6, 352] until compelled, MGO. 11-7-20, to take leave to Europe on mc.

After return was employed in QMG.'s office, and then, MGO. 9-11-24, appd. DSG. on death of Mountford [321, 342]; "I not only required a considerable time to become acquainted with the extensive and important duties, ... but...I was confined with a severe attack of fever, and was not relieved for some time afterwards from regular attendance at the Quarter-Master-General's office"[7].

A good administrator, and made thorough examination and report on the svys. of the various Madras dists. [4-5, 102-4, 114, 118-21, 321]; continued to hold post till its abolition [208-9, 221, 279, 301, 328, 376-7]. 1827-30, held ch. of Madras Obsy. after Goldingham's departure [191]; DDn. 237 (213), granted 3 mo. leave to Nīlgiri Hills.

On abolition of post of DSG. in 1833, declined appt. to GTS.

MOORCROFT, William [II, 430-1].
Vet. Surg. b. Lancashire c. 1786.
d. 27-8-25, Andkhui, Afghānistān.

Left nat. son and dau., who were both in India in 1841,[8] *JASB.* X (401); Richd. (b. Oct. 1818), Mad. Inf. 1835-55; Anne m., London, 18-7-35, Maj. Geo. St B. Brown, Bo. Inf.

ed. Liverpool as surg.; studied vet. science in France, and practised several years in London.

DNB.; *DIB.*; *Moorcroft & Trebeck*, I (xvii to xlvii). *As J.* XIX., 1825 (838); XVIII, ns. 1835 (289). 1836 (35-42; 95-102); Davis (10, 20-3); *Calcutta Rev.* I (449).

Left England May 1808, and assumed duty, 4-12-08, at Pusa, Bihār, as Vet. Surg. to Bengal Govt., and Supt. of the Company's stud.

May to Nov. 1812, visited Mānasarowar Lake with Hearsey, travelling in disguise via Garhwāl and Niti Pass [II, 80-1; III, 286]; brought back hill ponies and long-haired goats; held up by Gurkhas in Kumaun on return journey.

1812-3, his agent, Mir Izzat Ullah [II, 431] had explored routes Kashmir-Yarkand-Bukhāra-Kābul. The following description of the road over the Zoji La Pass is taken from an account pub., 1825, in *Cal. Qy. Rev.* [xxi, 276, n.7][9].

"The last station in Cashmir is called SONAMURG. It is a village of some 50 or 60 houses; the road is difficult and rocky, so as to be impassable to a mounted traveller. The road has the Sindh on the right hand. ...

"North East from Sonamurg, five cos. is Baltal, ... with ...one house for the accommodation of travellers; along the skirts of the mountain on right of the road runs the Sindh; the road is broad and practicable. Yaltal is within the limits of Cashmir, but close to it; on the east runs a mountainous elevation which separates Cashmir from Tibet; thenceforward the road is over mountainous...paths, but abundant in springs. ...

"After leaving Baltal about 4 ghurrees, the road ran over the top...and was practicable enough; on the descent it lay under frozen snow for about an arrow's flight. One cos from thence on the right of the road, and on the summit of a hill, two large blocks of stone were observable. ... The place is called Wahasugan. ...

"On this spot arise several springs, half of which flow to Tibet, and half to Cashmir. ... The River of Tibet, after leaving that country runs by Muzzafferabad; below Muzzafferabad one cos, it unites with the river of Cashmir, and the

[1] Mitchell to Malcolm, Jālna, 6-8-21; DDn. 191 (442-5). [2] SG. to Govt., 24-7-30; DDn. 402 (82-95). [3] DDn. 465 (107), Feb. 1848. [4] *JASB.* IX, 1840 (80). [5] Markham (89, 199-200). [6] DDn. 154 (7). [7] DDn. 203 (231), 12-9-25. [8] Ben. Wills, 1826. [9] cf. a more exact tr. of his notes, *Izzat Oollah* (7-8) [xx].

combined river descends to the Punjab under the name of Jhelum or Behu't." After this little error about the source of the Kishenganga, Izzat Ullah describes the onward road to Dras, which had already been recorded by Macartney as *Draus* [II, 271 n.4], and was visited ten years later by Moorcroft himself.

1820, Moorcroft obtained leave on full pay, intending to travel to Bukhāra via Ladākh and Yarkhand, to purchase Turkoman horses for improving horseflesh in India. To facilitate and finance the journey he persuaded Palmer & Co.—and Cruttenden & Co.—of Calcutta [472–3] "to entrust to his care a supply of goods to the value of about 3,000 pounds".

He took with him as survr., Geo. Trebeck, son of a Calcutta lawyer, and Wm. Guthrie, a sub-asst. surg. from Bombay [508].

The party comprising 300 persons, 16 horses and mules, and 200 maunds of merchandise, left Bareilly in Oct. 1819, and reached Bilaspur on the Sutlej, 12–3–20. From Bilaspur Moorcroft visited Lahore to obtain a permit from Ranjīt Singh, whose troops had occupied Kashmir since 1819[1]. Leaving Bilaspur in July they reached Leh in Sept., Trebeck keeping svy. of route, and, with Moorcroft, obsg. lats. and heights [43–4]. Hoping for permit to travel via Yarkand in Izzut Ullah's tracks [II, 431], they stayed two years in Ladākh making further svys., whilst Moorcroft won reputation by successful operations for cataract.

Sept. 1822, hearing from Yarkand that Chinese refused authority to travel by that route, Moorcroft determined to reach Bukhāra via Kashmir and Kābul. Leaving Trebeck to follow, left Leh 20th; at Sonemarg received permit from Ranjīt Singh to enter Kashmir.

Reached Srinagar 3rd Nov., staying at garden house for the winter. As at Leh, practiced medicine and made occasional excursions. Traded in Kashmir shawls. Throughout his travels recorded most interesting facts about country and people. A great authority on these regions, Alex. Cunningham, records nearly 30 years later that "he found Moorcroft absolutely trustworthy, and one of the most conscientious men that ever lived", and similar verdict had been given by his bro. Joseph after travels in Ladakh in 1843 (452)[2].

During stay at Srinagar, Moorcroft found a copy of *Radja Tarangini*, the ancient chronicle of the Kashmir rulers. "Tracé sur des écorces de bouleau", it was brought to his notice by a *pandit* he had cured from a well-nigh incurable disease. He emp. 10 *pandits* for 3 mo. to make a copy, which he sent down to the Sanskrit Coll. at Calcutta, where it was edited. It was then tr. and pub. by Troyer in Paris [II, 448 n.1][3].

He now obtained official permit to travel via Peshāwar. Leaving Srinagar 31–7–23, made an abortive attempt to march down the Jhelum valley, but stopped by armed force below Baramula and had to return to Srinagar. Starting again 11–9–23, the party crossed into Pūnch by the Pir Panjāl pass, and reached Peshāwar 9th Dec. via Jhelum and Rāwalpindi. About 8 years later Vigne found that the Rāja of Rājaori had happy memories of Moorcroft and his "little spaniel called Missy"[4].

They left Peshāwar, 24–5–24, after 5 mo. halt; reached Kābul 20th June ; on the road "thieves stole Trebeck's cloak, blanket, pistol, and what was a severe loss, his compass, one made with sights". On leaving Kābul, 17th Aug., their Kashmiri and Gurkha followers returned to India [44]. Their caravan of laden camels and rumours of great wealth excited the cupidity of the Uzbek chief of Kunduz, whom Moorcroft found it politic to visit from the border town of Khoolum and, writes Burnes, who found himself in a similar predicament 7 years later, "having made him some presents, returned to Khoolum.

"He had no sooner arrived there than he received a message from the chief, ... requesting that he would hasten his return, and bring...his medical instruments and Mr. Guthrie. ... It was merely a plan to ensnare him. ... After a month's delay, he only succeeded in liberating himself by complying with the most extravagant demands of Moorad Beg."

Izzat Ullah had accd. Moorcroft to Ladākh and Turkistān, and gave him loyal support in his dealings with Murad Beg at Kunduz. Being now seriously ill, and the trouble being apparently over, he took leave, and set out for India, 16–12–24[5].

"The party" writes Burnes" prepared to quit Koolum for Bokhara, but on the very eve of departure were surrounded by 400 horsemen, and again summoned to Koondooz [*c* 30–12–24]. It was not now concealed that the chief was resolved on seizing the whole of the property, and putting the party to death. Mr. Moorcroft took the only course which could have ever extricated his party and himself. In the disguise of a native, he fled at night, and after a surprising journey, at length reached Talighan, a town beyond Koondooz, where a holy man lived" [IV, pl. 16]. With his protection and intercession they were at last released, having paid blackmail of about Rs. 7000[6]

They crossed the Oxus 11–2–25, and reached Bukhāra 25th. Here Moorcroft purchased valuable horses, and recrossed the Oxus on his return about 4th Aug. ; he turned aside with a few followers to buy more horses at Mainmana, but took ill with fever and died at Andkhui. His body was buried at Balkh, where Guthrie died shortly after. To complete the tragedy, Trebeck died at Mazar-i-Sharif, after 4 mo. illness [44, 282, 508].

Intense interest in this journey was taken both in India and England, and Moorcroft's letters were pub. at the earliest opportunity as they reached his friends ;— *JRGS*. I, 1831 (253–47), etc.— the tragedy of his death made a great stir.

The following comments are taken from Mohan Lal, who travelled that way with Burnes 7 years later [452] ; 10–6–32. "We halted at Mazar...and put up in the same place where Mr. Trebeck died of a fever. ... All the property of Mr. Moorcroft was forfeited by the ruler of Mazar on the death of Mr. Trebeck. ...

"Mr. Moorcroft...was received by the King of Bokhara with honor and distinction on account of his wealth and respectability, ... and, having made presents to the king, was permitted to ride within the city on horseback. ... It was after his return, ... and when he was proceeding in search of the Turkman horses in the district of Balkh at Andhko, that he was attacked by fever and died.

"The circumstances attending his decease, though not of suspicious nature, yet are not sufficiently clear to dispel all doubt, but the reasonable conclusion is that his decease was a natural event. ... His remains were scarcely allowed a burial place at Balkh owing to the bigotted zeal of the inhabitants".

Burnes describes his visit to "the grave of poor Moorcroft. ... Mr. Guthrie lies by his side...under a mud wall which had

[1] Sikhs formally annexed Kashmir and Peshāwar in 1834. [2] Burrard & Hayden (35) ; *JASB*. XIII, 1844 (172–222) ; XVII, 1848 (201–30). [3] Troyer, I (iii–iv) ; Moorcroft's letter from Srinagar, 20–7–24, *As R*. XVIII (517). [4] Vigne, II (228). [5] *Moorcroft & Trebeck*, II (92, 101, 415–35). [6] *Bokhara*, II (181–2) ; Holdich (442–7) ; Murad Beg's demands had varied from Rs. 20,000 to 2 lakhs *Moorcroft & Trebeck*, II (453–86).

been purposely thrown over. ... The...people of Balkh refused permission to the travellers being interred in their burial-ground. ... He was unaccompanied by any of his European associates, ... and was brought back lifeless on a camel after a short absence of 8 days"[1].

Mohan Lal records that he "left a name of humanity and wisdom that will long be remembered in Turkistan. ... Mr. Moorcroft's books, papers, and some manuscripts, are at Mazar, a town about 12 miles east of Balkh. I regret that we could make no attempt (without raising suspicion of our motives) to procure them. ... Papers and journals have been recovered by the exertions of Mr. Fraser at Dihli, and by him arranged and sent to Calcutta"[2].

All the papers that had been recovered by 1834—including those received by Chas. Trebeck from his bro.—were taken to London by Alex Burnes, and passed for pubn. to Dr. Wilson. Other papers were later recovered in 1838 by Dr Lord who visited Mazar-i-Sharif and recovered "50 volumes of... printed works[3]. ... The remainder, including the maps, Mr. Moorcroft's passports in English and Persian, ,.. and a ms. volume...chiefly of accounts, I was enabled to recover when...I myself made a visit to *Khoolum* and *Moozar*". He found a note by Trebeck that Moorcroft had died on 27th Aug., and evidence that satisfied him that death had not been caused by "unfair means".

From notes about the goods sold at Bukhāra, Lord concluded that "the proceeds were chiefly expended in the purchase of horses, of which...he had when he died somewhat under a hundred. ... His character was highly appreciated by the King [of Bukhara] who frequently sent for him to enjoy the pleasure of his conversation, and conferred on him the high privilege, never before granted to a Christian, of riding through the city and even to the gates of the King's palace, on horseback"[4].

Though his primary object was the purchase of horses, Moorcroft, with Trebeck's assistance, did much to open up the geography of the countries he visited. Their diaries were ed. by Horace Wilson, and pub. London 1841[5], with illustrations and a map. A brief critical summary of his travels is given by Professor Davis in his Raleigh Lecture, 1918, entitled *The Great Game in Asia (1820–1844)*[6].

MORLAND, Henry. Mad. Inf.
b. 4–10–03. d. 23–12–68.

Ens. 13–2–21 ... Maj. 9–11–46; inv. 17–3–48; ret. 6–1–53; Hon. Lt Col. 28–11–54.

Son of James Morland, coal merch., of Deptford.

m., Calcutta Cath., 30–6–40, Georgina, dau. of Chas Rooke, of Brighton; his dau. Bella m. John Peach Holdich., RNR., and d. 9–12–1934.

MGO. 12–2–28, appd. Asst. Survr.; DDn. 184 (466), 7–3–28, to join Hyderābād Svy. from Madras, by sea to Masulipatam [119]. Feb. to May 1829, on svy. of Pālnād; "very little acquainted with the duties of surveying", but svy. described as "excellent" [96–7]. DDn. 237 (199), 2–10–29; to ch. of Hyderābād Svy. from 1–8–29; [119, 351].

In ch. Hyderābād Svy. off and on till Jan. 1848, after promotion to Major [5, 342].

MORRIESON, Hugh [II, 432]. Ben. Inf.
b. 1–12–1788. d. 27–8–59[7].

Ens. 28–8–04 ... Lt.-Col. 13–1–34; ret. 11–8–41, Hon. Col. 28–11–54.

Son of David Morrieson, Ben. Inf. (d. 1809, Hodson); and Rachel Wightman his wife; bro. to David (1783–1821), BCS.; Robert (b. 1787), BCS.; Wm. Elliot (1791–1815), Ben. Engrs. [II, 432], and Nasmyth (d. 1846), Nizām's Army.

m., 11–6–44, Elizabeth Constantia, dau. of Richd. Pryce and widow of Capt. Robt. Campbell, RN.

Hodson, III (333).

1812–3, Asst. Survr. in Mirzāpur [II, 45]; 8–5–13, tr. to Sundarbans, taking ch. from his bro. Wm. in May 1814; Feb. 1815, joined unit for mil. service, Nepāl War [II, 16–7; III, 12, 139, 425].

BGO. 17–10–15, appd. to officiate as Asst. in SGO. [309], Crawford pointing out "his willingness to do the duty on his present allowances...being at this moment in Calcutta, having come from Benares on duty in attendance on a sick officer. ... Should he ...be employed in the surveying line, it would be of the greatest consequence and advantage to him to have served some months in the Surveyor General's office"[8]. 7–2–16, handed over to Hyde [462].

On departure to England Crawford left a note for Mackenzie, 28–12–15; "This will be forwarded to you by a protegé of mine of many years. He has been in my family [II, 413; III, 468] for seven or eight years, and has been twice my assistant [II, 45, 392]. His welfare I am particularly anxious about, and nothing could give me greater pleasure than to hear of his success in life. He stands high on the Lord's[9] list, from his being nephew to Sir Hugh Inglis, late Chairman[10].

"He is very anxious to be re-appointed to the survey of the Sunderbunds, which was for two years carried on by his brother, but fell in the Nepaul War [II, 432], and scarcely had recommenced the work before the Lord sent him to his Regt. on account of the late hostilities"[11].

BGO. 22–5–16, to resume svy. of Sundarbans, on recdn. of Rev. Bd. [7, 12, 140]; 1–1–17, appd. DAQMG., 1st cl., and to continue the svy. [142–3, 179, 335, 348].

1817, given asstce. of 3 appces. straight from school [360–1, 363] but had to break off svy. in April 1818. "I have generally spent the rainy season at Soory with my brother [488 n.2]. Had I not been sick, it was my intention to have gone to Soory when the rains set in, to have brought up my own map, and to have employed the boys and Captain MacGregor[12] on a trigonometrical survey all round the station ...and to have included the neighbouring hills [328].

"This as a private piece of work would have given them all information and practice, but as I am sick now and cannot go to the Sunderbunds, Doctor Young[13] at first wished to send me to the Sand Heads but, on considering the boisterous weather, he changed his mind, and said that when I should have taken mercury enough here, he would recommend my taking a trip up the country, so as to keep out of Calcutta during the rains. I mentioned to him Soory, on which he enquired as to its climate. He said he thought it would be as good a place as any other, being a high kunker soil [II, 388 n.5], dry and warm in the rains instead of damp and cold. Now I shall be able to proceed there sooner than the 14th of

[1] *Bokhara*, II (209–10); *Moorcroft & Trebeck*, I (xlix). [2] Mohan Lal (94–129). [3] out of 90 books, chifly medical, a total of 87 were recovered. [4] *JASB.*, VII, 1838 (665–6). [5] *Moorcroft & Trebeck*. [6] Davis (20–3). [7] Markham (82) assumes death 1818, misled by Gastrell, who found his fdbks. broken off that year. [8] DDn. 143 (151), 10–10–15. [9] Lord Moira, GG. & C-in-C., later Mqs. of Hastings. [10] of the CD., EIC.; Morrieson's gt. uncle Hugh had changed his name from Wightman to Inglis. [11] DDn. 147 (14–6). [12] John MacGregor (1783–1822); Ben. Inf.; joined Morrieson 22–3–18. [13] Henry Young (1782–1844); Ben. Med.; Crawford's *Roll* (B 529).

June (...I trust...it will not be necessary for me to continue this course of mercury so long !)[1].

Writes from Suri, Birbhum[2], 5-8-18, "forwarding an unfinished sketch of...part of the Jessore District, exhibiting a view of the work performed during the 18 months the survey has been actually prosecuted. ... My late severe illness, brought on by constant exposure to the sun, prevented me from filling up the space left blank, but I propose doing this in the ensuing season, so soon as the rain water shall have ran off from the country"[3].

Again, on sending in his final fdbks., 17-8-18; "With regard to carrying the survey more to sea, no doubt it would be good to have the knowledge, and I imagine small but safe vessels could be set out and in amongst the sands. A man brought up at sea, however, would be necessary to undertake all the direction of naval concerns; the navigation should be intricate as the sands are numerous.

"There are some petrifications in this neighbourhood [Suri] of trees, plants, and some pure crystals. I shall bring down some specimens with me"[4].

31-8-18; "It is my firm intention to proceed on my survey in October, God willing. I do not feel well, but I have great hopes that the cold weather will do much for me, and under that impression I could not with any degree of propriety hesitate in recommencing my work. If after a fair trial I find it in vain contending against sickness, I shall then with much regret give up a piece of work in which I am much interested"[5].

Suri, 8-9-18, asks for notice to be sent to officials in the Sundarbans of his coming season's programme, and that arrangements be made for suitable boats, and concludes; "I have had several letters from gentlemen in the Sunderbunds, requesting to know when my survey will extend their length, as they were very anxious to have a map of the country, but they must have patience"[6].

It was not to be, and on returning to Calcutta, he had to ask for long leave; "the medical gentlemen think...I should make a voyage to sea with as little delay as possible. I am accordingly preparing to proceed to the Cape of Good Hope by an early opportunity"[7]. Under BGO. 28-10-18, he was "permitted to make a voyage to sea, for the benefit of his health, for 10 months". Further extensions brought his leave up to 7-10-20.

Like his bro. before him [II, 17, 432; III, 12, 344] he had many adventures with tigers and other wild creatures; "On the edge of the jungle on the Pussur River the country was formerly much more cultivated, but the tigers became so numerous, the people left it [76]. It is now partially cultivated only at Diggerazabad. During all seasons of the year the people say they shut themselves up about 5 o'clock in the evening, and stir not out till the sun be well up. But in the rains the tigers come in numbers, and at all hours of the day. The people are constantly carried off.

"In the Roymangal River, having come to an anchor, we saw a rhinoceros on the opposite side of the river drinking. I crossed in a pansway[8]: he allowed me to approach to within 30 or 40 yards. I fired at his head and put the ball through his cheek; he ran off into the jungle before I could get a second aim at him. On reaching the pinnace I learnt from the party I had sent on shore that they had been successful in finding a tank of good water under the cocoanut trees; it was, however, surrounded by long grass and other jungle, the haunts of many rhinoceroses; they had made a regular bed in it. Being anxious to save a trip all the way to Chandcalley for fresh water, I went on shore with an armed party carrying firebrands, with which we soon set the whole place in a blaze. I left it to burn out, meaning to return in a day or two to try and fill our casks.

"About this time four very large dingees, ... each having about 50 men on board, passed us at a prodigious rate. We reckoned them dacoits from their appearance, and when we called to them they returned no answer, nor paid the least attention. ... They may be...going out to look for boats in distress that have been separated from the regular fleets by stress of weather, and of course helpless against such a number of men"[9].

After rejoining from leave, Morrieson resumed his appt. as AQMG., and was employed, BGO. 3-2-21, on road svy. and construction, Barrackpore-Kishengarh-Berhampore, and on svy. in Mālwa [27, 87, 337′]. BGO. 6-8-24, attd. to E. Div. of army under Shuldham at Dacca [65].

MOUNTFORD, Francis [II, 432-3].

Mad. Inf.

bapt. 23-7-1790. d. Madras, 11-7-24.

Ens. 25-10-09 ... Bt. Capt. 30-4-23.

Son of Thomas Mountford, of Worcs.

m., Madras, 13-1-23, Emily Haselwood, probably dau. of Joseph Haselwood, Mad. Inf. [II, 410 n.3].

March 1810, MMI. cl. v [II, 321], remaining, with Montgomerie, to compile the 1-inch and ½-inch maps, completing these under control of the SG. in 1817 [II, 129; III, 95, 485].

Troyer testifies, 22-5-16, "to the uncommon talents and indefatigable zeal evinced, ... as well as...for instruction of the Military Institution"[10]. As asst. instr. held ch. of svy. in Guntūr 1815-6; MMC. 19-6-17, after closing of MMI., given ch. of remaining svy. of Guntūr left incomplete [96, 206-7, 338, 474].

Mackenzie had "a good opinion of his discretion & judgement", and Ward writes from Travancore, 28-11-18, that "I should like well he was with me, having already the pleasure of his acquaintance, but only fear his constitution will suffer in a climate where bowel complaints & the liver are the predominant disorders, to the latter of which I know him to be very subject"[11].

Sept. 1818, on Riddell's death, called down to Madras for ch. of SGO.; held post till death, after being upgraded to DSG. 18-4-23 [4, 112, 117-8, 213, 291-2, 297, 318, 320, 339]. Held entire confidence of Mackenzie, whose full and intimate corr. with him between 1818 and 1821 is still preserved [116, 120, 277, 319, 374-5, 401, 450, 476-9].

A warm appreciation appeared in the *Asiatic Journal* of March 1825; "Capt. Mountford, DSG., was a man equally distinguished by his public and private virtues. He entered the service without having one friend upon whose interest he could rely for advancement; and by rare merit, and diligent discharge of his public duties, he raised himself to the important situation which he held at his death. But although thus distinguished as a public officer, it was in the quiet walk of domestic life that the amiable qualities of his heart were most conspicuous.

"He was a most sincere Christian, and unwearied in the service of his great Master. ... In his short career through the service he invariably acquired the esteem and friendship of his associates, and the approbation of his superiors. He was Secretary to the Literary and to the School Book Societies [481], ... and obtained their repeated thanks for the... advancement of both institutions"[12].

[1] DDn. 147 (137), 27-4-18. [2] staying with his bro. David, BCS. who had son b. Suri, 14-2-13. [3] DDn. 147 (148-9). [4] ib. (150-1). [5] ib. (152). [6] ib. (157-9). [7] from Morrieson, 15-10-18; BTC. 16th (120); DDn. 133 (415). [8] country boat ? [9] Sherwill (18). [10] MMC. 15-6-16. [11] DDn. 156 (191), 28-11-18. [12] *As J.* XIX, 1825 (263).

MURRAY, Hugh Robertson. Ben. Inf. b. 1-8-1789. d. 24-1-77.

Ens. 1-8-07 ... Bt. Maj. 10-1-37; ret. 2-8-39; Hon. Lt.-Col. 28-11-54.

Son of Robert Murray, of co. Ross.

Hodson, III (359).

Oct. 1816 to March 1817, on search in Kumaun for Ordnance Dept. for paper-making material; work closed owing to sickness; granted reward Rs. 1,000.

DDn. 131 (19), 8-3-17; SG. sent him a perambulator for svy. of "the hill country of Kumaun".

NELSON, Horatio Ralph. Rev. Survr., uncov., d. Dehra Dūn, 13-2-39.

Asst. Rev. Survr., 27-11-22.

Had chequered naval career;—joined HMS. *Sir Francis Drake* 13-4-07—Master's Mate 1-6-09—Mdpn. 1-11-09—disrated to Ordinary Seaman 6-5-13—disch. 13-8-13, "for repeated misconduct, and being...totally unfit for the situation of an officer in H.M. Service".

Arrd. India 1818; land survr. "Asirgarh"; *local* ens. Rampura Local Batt.[1] 11-8-18 till disbandment *c.* 1821.

Hodson IV (575).

1807-8, sailed in HM. frigate *Sir Francis Drake* with Capt. "Sneyd's[2] Embassy to the Court of Cochin China". Whilst at Hué, capital of Cochin Chinese empire, Sneyd obtained part payment of a claim made by a Madras business firm, on account of arms and ammunition supplied[3]. This was not the first time that this firm had sought the agency of the RN. on similar quests.

Whilst at Hué, Nelson survd. its harbour, Huron Bay, on E. coast of Annam. Chart, MRIO. 105 (24-5) gives soundings, with notes—"Sir Francis Drake's channel into Hansas or Turon Bay, by Hor. Nelson, RN—The natives of Cochin China are not a treacherous & sanguinary race, as stated by French & Portuguese Jesuits. This report was made to keep other Nations away. HN."

He writes of his first employment in India; "Having been employed with an Embassy to the Court of Cochin China many years ago under Clement Sneyd Esq., I presented a MS. narrative of the manners, trade, and other localities of the country, which won His Lordship's[4] approbation, ensured me his thanks & marks of his attention.

"During the better part of the Mahratta War I was employed under the orders of the Commnrs. of the Northern Conkan in the Survey Department, & after some duties performed in that quarter, came round to Bengal at his Lordship's desire, who asked if I was willing to accept of employment in the Survey Department. I...was appointed to do duty with the Moradabad Revenue Survey"[5].

27-11-21, appd. Asst. Rev. Survr. on Rs. 250 pm., and posted to Morādābād under Bedford [154, 332, 370].

BTC. 17-9-24 (28), to mil. duty, Aracan, reporting to Schalch [151, 333, 370], who welcomed him for comd. of his private "three-masted schooner", the *Dragon* [501], which had been "armed", and "appropriated to warlike and survey duties". "Major Schalch invited me to dinner, and asked me if I had any objections to take the command of a fine schooner belonging to himself, and to remain with himself, and as I was a naval person he would procure the sanction of Government for me to command the vessel regularly. In a day or two after this, Major Schalch declared that he had received the sanction... and that I was to receive an additional allowance. ... I was to be employed more as a Marine Surveyor than otherwise, but...should have to act in every capacity both on board & on shore, and that the schooner would be well armed for that purpose. ...

"I came on board...with Major Schalch, & received charge of her from him, as her future commander. Major Schalch likewise told me that I had no further occasion for tents, cattle, or horses, & that I had better dispose of everything... as all my future duties would be on board the vessel. ... I have neither tent, horse, or cattle for carriage, nor servants, or anything indeed to enable me to perform land duties as surveyor".

On Schalch's death, the *Dragon* was taken over by the army, with all her staff including Nelson, and "was employed in the batteries, storm, & capture of Arracan [68]. On the fall of this place I was directed to survey the rivers and creeks in the interior. ... It was General Morrison's desire I should make a survey of the rivers & creeks round about the camp, & to connect them". The staff had been disorganized by sickness and Nelson had to appeal for orders, "how far General Morrison wishes me to proceed up or down such rivers or creeks as I may fall in with, and whether or not I am to proceed to any considerable distance from the Force without support of some gun boats, and in such case that he should...to direct a guard of sepoys to be put on board my vessel as a protection against war boats, or surprise of the enemy. ...

"I would also...send...my earnest entreaties that he would... order me my salary for February, being entirely destitute of money to buy in any supplies, or pay my servants, and if the Brigr. would likewise be pleased to order an issue of pay to the crew of the vessel under my command, who for some time past have been obliged to depend solely upon myself for the advance of their wages, and which is now no longer in my power to give them[6]".

In a later report he tells the SG. that he "was ordered to proceed with the expedition under Major Buck[7] against Ackyoon, near Talac, at which latter place Captain Drummond, DQM Genl. of the force, ordered me to remain in charge of the flotilla, till such time as I settled the latitude by frequent observations, and surveyed the town of Talac. Having performed this duty, I was to proceed across the country to seek for a place named Aeng [71, 494], said to be about half a day's journey from Talac. Taking with me a guard of 12 flotilla men, I commenced my journey, and, instead of half a day, I was nearly 4 days and nights in the wilds of this desolate country—without food for two—and so exhausted and swollen from head to foot, that I was forced to be carried by the Burmahs who came out to see me into the town, where I arrived nearly starved and half naked. Owing to the rocky beds of the nullahs and impervious jungles. I had to force my way thro' without a shoe to my foot. ...

"On my return from this service to Arracan I was siezed with severe fever and ague, ... which reduced me nearly to death. Finding it impossible to regain my health, I was ordered to Bengal, and on my arrival was so ill that I was despaired of by the medical gentlemen who attended me. A change of air had become necessary. ... I therefore gained permission ...to visit the hills of Upper India. After some months I recovered my health in a measure, and was then directed to join the Delhie Survey"[8].

He had reached Calcutta from Arakan in Sept., and after ten days had reported to the SG., 27-9-25, that "illness scarcely permits me to hold a pen. ... I am compelled, Sir, to go up the river for my health to a cold climate. Can I render any service to your Department on my way?" He still had his old naval sextant and false horizon.

Posted to Delhi Rev. Svy. after several months

[1] Rampura, Indore State, 40 m. E. of Nimach. [2] Clement Sneyd (1773-1854), RN.; served in HMS. *Culloden* in E. Indies, 1804-7; Capt. HMS. *Sir Francis Drake*, May 1807 to June 1808; later R Adm. [3] B Pol C. 13-7-08 (7). [4] Mqs. of Hastings, GG. 1813-23. [5] to SG. 7-8-27; DDn. 225 (124). [6] DDn. 213 (95-6), Feb. 1825. [7] Nathl. Bucke (1799-1825); Ben. Inf. [II, 384]. [8] to SG. 7-8-27; DDn. 225 (127).

leave; he was not happy on land, and wrote to the SG., 22-8-26, on a "subject that has preyed upon my spirit. ... Placed in command of a...vessel, acting in the double capacity of a gun & survey one, necessarily recalled the feelings attached to my former habits of life, & where I should still have been well contented to have remained, had not my health suffered from the sickness at that time so prevalent in that country [Arakan].

"In the Revenue Survey of Moradabad I was happy & contented, & had I not returned to a sea life again as I did, I should never have troubled you. ...

"My health, ... being now fully & firmly re-established, I hope, I feel a strong inclination to return to the Sea. ... [and] get re-appointment, either to my old vessel the Dragon, or to any other. ... Were I permitted to chuse a station in India for survey, it would be the Eastern Islands, the coasts of Siam & Cochin China. ... "I have been a length of time, Sir, in the Eastern seas, & I have surveyed several of the islands on His Majesty's service, I have likewise been on an Embassy to the Court of Cochin China, ... and I have ...the permission of that Government to return. ... I...send you a map of my Survey...of the Naaff River[1].

BTC. 8-2-27, nominated asst. survr. under Comnr. in Arakan for rev. svy. duty, with allces. as River Survr. Travelled down river by *budgarow*, passing Fatehgarh 21-3-27, where he met Birnie Browne on his way up to Morādābād. Passing Buxar on 22nd April, his boat foundered in a storm, and he had to help another boat carrying a General with his family[2].

He reached Calcutta in May, making svy. of Jalangi R. on his way, "with a small compass and his watch"[3]. It now being too late in the year for Arakan, he was placed on duty at SGO., with his increased allces. there, but failed to get compensation for his "recent heavy losses on the Jumna & Ganges rivers on my passage down, by the sinking of my boats, and the total loss of almost every property.

Dissatisfied with his prospects in Arakan, and anxious about his health, he got his appt. cancelled, and reverted to the Upper Provs. leaving Calcutta for Sahāranpur, 15-9-27 [158]. Held ch. of rev. svy. detts. for several years under Wm. Brown.

There is no record of his marriage, and in Dec. 1834 he was an unsuccessful candidate for the hand of Gen. Ventura's sister-in-law at Meerut[4].

NEWPORT, Christopher [II, 433]. Bo. Inf. bapt. 1-11-1788. d. 13-8-44.

Ens. 25-6-09 ... Capt. 1-5-24; ret. as Bt. Maj. 5-1-42.

Son of Wm. Newport, of London.

m., Exeter, 1830, Ann Hoblyn, dau. of Rev. Edward Peter.

Oriental Club.

April 1812, appd. to Rev. Svy., Broach [II, 323; III, 123]; BGO. 31-1-20, promoted 1st. cl. Asst. [170, 343]. BO GO. 1-2-26, granted leave on mc. to Cape.

1839-42, Afghān War; comdg. Outram's Rifles, 23rd NI.

NEUFVILLE, John Bryan. Ben. Inf. b. 26-1-1795. d. 26-7-30, Jorhāt, Assam, MI.

Ens. 25-9-13 ... Capt. 16-6-26.

Son of Jacob Neufville, of Lymington, Hants., a French Royalist, and Sybella Phoebe his wife.

ed. Eton. Hodson, III (382-3).

1817, returned from furl.; BGO. 22-4-20, appd. DAQMG. 3rd cl.; ib. 6-5-20; attd. to road svy. in w. Provs., to report to Cawnpore; ib. 20-6-23, promoted DAQMG. 1st cl. [337].

1824-5, Burmese War; Intelligence officer with force in Assam valley collecting valuable geogl.[5] infn. [53-4].

Nov. 1824, led a party on Kalang R., and surprised the enemy nr. Rahachoky; "Lieut. Neufville having pushed on ...came upon the enemy's chief guard, all of whom were either bayonetted or shot. ... The whole area from Rahachoky to Kalaiabar was thus cleared of the enemy within a fortnight of the commencement of the winter campaign[6]".

22-12-24, report from Koliabar, HMS. 665 (140); 29-1-25, mentioned in dispatches for recce. locating stockade. *Govt. Gaz.* 25-7-25, comdg. dett. on Noa Dihing, reports flight of Burmans. *As J.*, Aug. 1826 (129), "In beginning of May 1825, ... with a small detachment...posted at Now Dheeing Mookh, advanced against Burmese from Mogaum. In June...again ascended the Dheeing and captured stockade at Dupha Gaum and again at Beesa Gaum. The evacuation of this part of the country by the enemy and the liberation of several hundreds of Assamese captives, were the fruits of this success" [423].

1827, made several route svys. in Rājputāna including MRIO. 84 (50), map of Sirohi Palanpur, Mt. Abu [87].

HMS. 671 (823), letter from Sadiya, 22-12-27, on pol. duty; 10-3-28 till death, PA. Upper Assam, and Comdt. 1st Assam Lt. Inf.

His "vigour, enterprise, and high reputation among border tribes, have been mainly responsible for the prompt supression of disorders before they could become serious"[7].

Auth. of paper "on the Geography and Population of Assam", *As. R.* XVI 1828.

NOBLE, Horatio Nelson. Mad. Inf. bapt. 5-4-03. d. 14-7-50, Jālna; MI.

Ens. 13-3-21 ... Maj. 1-10-46.

Son of Capt. James Noble, RN., and Sarah his wife.

m., 1st London, 31-3-28, Fanny, dau. of Samuel Smith; she d., London, 31-3-29.

m., 2nd., Cape Town, 16-11-30, Henrietta Moulton, who d., Mangalore, 23-3-32.

m., 3rd., Mangalore, 22-4-33, Mary Grier, dau. of Lt.-Col. G. Jackson, Mad. Inf.[8].

Crofton, II (135).

DDn. 201 (104), 19-7-25, nominated for svy. dept.; MMC. 8-11-25, appd. Asst. Survr., 2nd cl.; joining at Presdcy. from Regt. at Jālna. DDn. 202 (308), to Cannanore for Malabar Svy. [114, 342]; 1826, 10th to 30th April, at Calicut under med. treatment, "unable to attend to his field duties... having an ulcer on his leg"; 15th June, 2 mo. leave to Presdcy.

DDn. 222 (201), 26-11-27, leave to Europe "on most private urgent affairs".

NORRIS, Francis Brooke. Lieut., Nāgpur Service.

Appd. Nāgpur service 13-11-19; disch. 6-6-30; Civ. Engr. & SG. Ceylon, 1833-46; Civ. Engr. 1846 till *c.* 1851.

pr. related to Sir Wm. Norris, CJ. Ceylon, 1836.

m., 1st., Ghundawass, Bombay, 5-5-29, Isabella, dau. of Geo.Wm. Gillio, Bo CS. [496]; she d., Colombo, 21-6-39, bur. at Galle Face cem.

m., 2nd., pr. in Ceylon Aug. 1841. His bride arrd. 13th in *Tigris*, and he wrote to Govr. on 29th; "Mrs. Norris is quite pleased with what little she has seen of Colombo"[9].

[1] DDn. 225 (67). [2] to SG. 22-4-27, DDn. 225 (99-100, 106). [3] MRIO. 166 (7). [4] *Indian Archives*, I; Jan. 1947 (19). [5] *As R.* XVII (324-5). [6] Bhuyan (537-8). [7] ib. (544-5, 561). [8] cf. *Gen Mag.* June 1953 (370). [9] Ceylon MI. (51).

1822, appd. to Nāgpur svy.; 1822–3, accd. Resdt. to svy. route to sources of Māhānadi and Narbada. 1823–4, detail svy. under Stewart [504], taking over ch. on Stewart's death, 4–5–24 [91–2, 388].

On close of svy., 1–6–30, Resdt. remarks that "the unremitting zeal...and spirit, with which he has prosecuted...the survey in unhealthy jungles, ... has often nearly cost his life"[1]. With his asst. Weston, spent several mo. at Calcutta completing maps and reports handed in to SG., 2–3–31 [93, 370, 513].

Norris writes, 21–3–31; "Having lost my appointment in consequence of the abolition of the Nagpoor service, and there being so little opening for a person not in the Company's [service]...I have determined upon returning to Europe in the hope of being appointed to a situation in one of His Majesty's Colonies". ...

"I have been actively employed in the duties of the survey upwards of eight years and, since May '24, have had the uninterrupted superintendence of it. ... I was never once absent on private, or on sick, leave. ... Every possible extension was made, and many great difficulties were overcome, in carrying it through tracts...which had never been previously explored, and where the climate is...extremely insalubrious at all times of the year.

"The map...contains a connected survey of upwards of 24,000 square miles, the most extensive, I believe, on the records of your office that has ever been conducted by one person". He suggested that as the expense...has hitherto been only 6,740 rupees" to the Company, "the Directors might afford to "grant me some reward, ... as I am about to embark for Europe after a service of upwards of eleven years in the Nagpoor Territories, with barely sufficient means to support me for a few months"[2].

The SG. commented that "Mr. Norris' map...may be safely pronounced a very creditably executed work. It is on a scale of 4 miles to an inch, and —...although it is impossible...to appreciate the value ...without...time...to...verify all the calculations on which it is founded...—is...a very valuable accession to the geography of India. ... The maps are perfectly unique nor is anything like them, executed on this side of India, in the records of this office" [pl. 10]. He strongly recommended him for a bonus of 12 mo. salary, but the Directors only granted the meagre sum of Rs. 1,000, in consideration of his having cleared up Stewart's papers after his death[3].

Norris sailed for England, Sagar I. 23–3–31, in the *Fugupore*, and the following year was appd. to Ceylon service. Under Sec. State letter 26–8–32; "Mr. F. B. Norris, who had been employed under the East India Co. in very extensive surveys, is appointed to the situation of Civil Engineer and Surveyor General, on a salary of £800 per annum".

Assumed office on arrl. Ceylon 17–3–33; leave to England on mc. Dec. 1839–Feb. 1840; Civ. Engr. only Oct. 1846 till after Jan. 1851. Dism. "for allowing the head clerk to embezzle money"[4]; returned to India.

BGO. 25–7–54 (727), from ch. of Iron Bridge Yard Calcutta on 500 pm., appd. Civil Architect on Rs. 700 pm.; BGO. 5–12–54 (1225), permitted to resign. 1855, railway contractor at Allahābād; pr. d. in India.

OLIVER, Thomas. Ben. Inf. b. 17–11–1789. d. 22–4–72.

Ens. 17–3–05 ... Lt Col. 3–7–32 ... Gen. 19–6–66.

Son of Samuel (d. Capetown, 1859 aged 74), and Susan Oliver; bro. to Wm. Oliver (1781–1846), MCS., who was staying with Mackenzie in Calcutta in April 1818.

ed. Marlow.

Oriental Club. Hodson, III (428).

Mackenzie obtained his appt. to the svy. after persistent efforts; "I requested Mr. Metcalfe to explain to His Lordship how far the Service would be benefitted by employing Captn. Oliver's talents. ... God knows what a burthen has devolved on me in the whole of these things. It has nearly overwhelmed me"[5] [477].

DDn. 144 (299), 27–8–19, nominated as Asst. Survr. on Sirmūr Svy., being content to serve under Herbert, his junior in mil. rank; joined at Sahāranpur, Dec. 1819 [2, 38–9, 329, 457].

BGO. 14–9–21, to officiate as Survr. in ch.

BGO. 1–8–22, on SG.'s special recdn.[6] [332] appd. to ch. of Rev. Svy. Delhi [148, 151, 154–6, 162, 333, 449] holding ch. until after promoted Maj., BMC. 10–4–29 [157, 301]. BTC. 2–6–29; to surrender ch. of Delhi svy. by Oct. 1829.

Between June 1828 and March 1830, obsd. lunar transits and occultations of stars at Gurgaon, 20 m. sw. of Delhi[7].

1831–4, serving with batt. at Nasirābād, submits to ASB. series of longs. obsd. by lunar transits and culminating stars, Feb. 1831 to Nov. 1833; also meteorl. obsns., Dec. 1832 to Aug. 1834. 31–12–31 to 28–2–32, obsns. for lat. of church bungalow, Nasirābād by altitudes of *polaris*, taken with "an 18-inch altitude and azimuth circle, now passed to Lucknow observatory". Appreciated by edr. *JASB.*, James Prinsep, as "it is a constant complaint of astronomers in this country that points of reference are not to be had"[8].

OLLIVER, Joseph [II, 435]. Civ. Asst. GTS. b. 1785/6.

Appce. 13–3–1800; Sub-Asst. Sept. 1804 ... Pricpl Sub-Asst. 11–3–24; Ch. Civ. Asst. 4–6–32; ret. 1842.

m., Secunderābād, 12–11–19, Mary Terry Adolphus. Father of; Andrew Cornelius—Thos.—and Chas. A. Olliver—all sub-assts. GTS.; another son, Mark Edwin, m., 1855, Serampore, a dau. of Chas. Joseph [321]. Nov. 1831, all four sons accd. De Penning from Madras to Calcutta to join their parents.

1800, appd. to Survg. School, Madras—1804–6, with Kater in Mysore [II, 364]—11–3–07, to Lambton's svy.; emp. on compns. and copying till sent out with De Penning in Aug. 1817 on trgn. of Gt. Arc N. from Bīdar [223–4, 325, 373, 378, 437]—with De Penning again in 1818—and from 1819 became Everest's right-hand man [118, 227–8, 230–2]—With Everest again, 1822–3, on longl. series w. to Sholāpur and with him at Hyderābād during 1823, acting as go-between with Dr. Morton [234–6, 443 n.8].

On De Penning's resn., 1–2–24, succd. as Senior Sub-Asst., Everest reporting, 29–3–23, that he had "for the last 5 years been employed under my own eye and, however trying or difficult the circumstances, ... I have never found him deficient in zeal or assiduity"[9]. ... At the period...of my illness I left him in charge of the operations on the Godavery in 1820 [231–2], and he acquitted himself most satisfactorily"[10]. ...

"Capable of connecting the Karangooly and Yerracondah meridional series, ... Mr. J. Olliver...will never feel himself at a loss in conducting any other principal series whatever. ... I...suggest...confiding the further management of the Great

[1] DDn. 264 (58–64), 1–4–30. [2] to SG., ib. (152–4). [3] DDn. 265 (165–8), 10–3–31; 262 (89), 11–7–31. [4] *Ceylon Lit. Regr.* VI (252, 259). [5] DDn. 164 (95), 19–8–19. [6] DDn. 196 (143). [7] *Gleanings in Science*, III (57). [8] *JASB.* I, 1832 (506–11); II, 1833 (128–9, 432–4); III 1834 (243) (IV 1835, 49–53). [9] DDn. 197 (37). [10] DDn. 171 (26), 27–5–23.

Meridional series to his hands in the event of my absence [9, 245, 254, 326, 380, 403, 414–5, 444–5]. ...

"Is a ready calculator. ... From having almost constantly under my superintendence since 1818, he has improved so much, and has gotten...completely into the method of applying the necessary formulae. ... He possess an invincible patience and perseverance, with the strictest regard to truth and integrity".

On these recdns. Olliver was promoted to salary of Rs. 400 pm. vacated by De Penning[1].

Nov. 1824, at meast. of Sironj base [380–1], incurred displeasure of Everest who was in a thoroughly neurotic state from constant ill-health [445]. Everest writes on evening of 22nd; "I desired you to be here to-day, early in this morning if you could be spared, but at all events...by four o'clock this afternoon. This positive order you have disobeyed, for I did not tell you to use your own judgment".

Olliver pleaded that he could not leave the clearing of the base, but Everest was not satisfied. "I see nothing which could not...safely have been left for 24 hours to the management of Murray Torrick [380]. ... You had a party of 6 sepoys under a very clever non-commissioned officer. ... Your conduct is quite indefensible. ... You will consider yourself under personal arrest untill the pleasure of the Supreme Government is known. ... "As it is not my intention that you should consider yourself under *close* arrest, you have the liberty of camp allowed you"[2].

Report was made to the SG., 29-11-24; "My 1st Sub-Assistant, Mr. Olliver, has been acting with great impropriety of late, and has at last proceeded to direct disobedience. ...

"I arrived at Seronj on the 7th instant, and...sent Mr. Olliver on the 10th to select and prepare a line for my base of verification in the plain east of the town, whilst I proceeded to the western tableland to fix the position of my meridian by circumpolar star observations.

"The task...is one of great fatigue, and to me was particularly so because I have but barely recovered from a slow fever which confined me to my bed for nearly a month [404, 445]. ... On the morning of the 21st, finding myself quite worn down for want of rest, I wrote...to Mr. Olliver, who was then about 12 or 14 miles distant, desiring him to attend...early in the morning on the 22nd, for...assisting me in taking some angles with the large theodolite, but *at all events* by 2 o'clock in the evening. This order Mr. Olliver disobeyed in toto, and I was...compelled from actual want of strength to forego a very important object. ... The excuse urged is that he did not think proper to leave the village labourers to work by themselves. ...

"If this had been the only instance of misconduct on the part of Mr. Olliver, I should have considered it as a venial offence, but it is far otherwise. He has on several occasions of late given me great cause to be displeased, ... and has shewn...wilfulness and inertness of which I before thought him incapable. ... He has experienced...the utmost kindness and indulgence at my hands. ... So bad a spirit should be crushed in time. ...

"I have desired him...to consider himself in arrest. I know not whether this measure is in strict accordance with the rules of the department, but...I could not with propriety allow a person who, by his wilful disobedience, had forfeited my confidence, to take part in these delicate operations. ...

"My only desire is to bring him to a proper sense of his duty, and to check in time a habit of insubordination which, if it once gains ground, will not easily be eradicated"[3].

Blacker agreed that Everest was fully justified in requiring the strictest discipline, but asked him to call on Olliver to express regret and promise future good conduct. Olliver's first reaction was defiance and a request to resign. Everest, however, gave him a month to think it over, and then reported to the SG.; "He waited upon me and expressed his sorrow and regret for what had passed, and his thanks for the considerate treatment...both at your hands and mine. ... I will, with your permission, ... consider the affair as satisfactorily settled"[4].

In 1825, when Everest decided that he must take sick leave to Europe, there was much discussion as to the empt. of the GTS. during his absence, and it was finally decided to give Olliver charge of a longl. series of triangles from Sironj to Calcutta, with an 18-inch theodolite instead of the great 36-inch one, which was now seriously out of order [259, 264, 442]. Everest emphasized the wild and difficult nature of the country and estimated that the work would take more than six years [241–2, 261–4].

"Where then is the single individual to be found to whom a work of such extent, duration, importance, and delicacy, can safely be confided. The person so selected should not only have a thorough practical knowledge of his profession, ... but he must be endowed with no ordinary portion of enthusiasm...to induce him to give up society and all the enjoyments of civilized life"[5].

Olliver was the only man to fill the bill, and Blacker told Govt. that he had "every reason, after mature discussion with Captain Everest, "to consider Olliver capable of the task"[6]. It was just as arduous as Everest had anticipated, but Olliver persisted in spite of trouble and sickness, and had brought his triangles to within a short distance of Calcutta, by the time Everest returned five years later [9–10, 87, 248, 252, 259, 261–4, 327, 404–5, 416–7, 495, 499].

No special increment of pay was granted for the great responsibility. Govt. thought it sufficient to hold out "expectation of handsome remuneration should he...be found to have fulfilled his duties with zeal, rectitude, and ability"[7]. They had not so far been generous, and Olliver had great difficulty in getting his travelling expenses when he went down to Calcutta with Everest in September 1825 [246, 353]. For the return journey; "To avoid detention... should sickness attend me, I have been induced to engage teka[8] palankeen bearers from Calcutta to Mirzapoor. I was also unfortunate in having lost a valuable travelling horse a few days before I left Calcutta; its complaint arose from fatigue on the journey from Cawnpore to Calcutta in the rainy season[9], and the beast died a week after reaching Calcutta. ... The horse stood me in at purchasing, 360 Hyderabad rupees equal to sa. rupees 302-8-4"[10].

He was staunch to the instrns. left by Everest, and firmly resisted the wishes of Hodgson that he should compute his points as he went along [257]. "I...hope that in two seasons more the work be terminated at Calcutta, when it will be gratifying to sit down deliberately indoors to complete the calculations; ... a far more preferable mode than all the hasty calculations in the field"[11].

In 1832, on Everest's warm recdn., Govt. authorized his promotion to Chief Asst., on Rs. 600 pm., which the Directors confirmed, whilst refusing any further reward.

1841, Olliver proposed "to cultivate a garden after retirement".

OMMANNEY, Edward Lacon. Ben. Engrs. b. 2-10-10. d. 3-11-96.

2/Lt. 13-12-27 ... Col. 18-2-61; ret. as Hon. M Gen. 1-9-63.

[1] DDn. 171 (174-9), 18-2-24. [2] DDn. 91 (479-87), 22 to 24-11-24; arrest was hardly the right punishment for a civil officer! [3] DDn. 172 (271-4). [4] DDn. 171 (316-8), 12-2-25 (359). [5] DDn. 172. [6] DDn. 204 (202-5), 24-9-25. [7] BMC. 11-11-25; DDn. 201 (173). [8] on contract. [9] whilst Olliver went by boat [246]. [10] DDn. 173 (5), 12-12-25. [11] ib. (97-102), 1-8-28.

Son of Edward Symonds Ommanney, merch. of Yarmouth and Henrietta Maria his wife, dau. of Sir Edmund Lacon, 1st Bart.

m., Dacca, 2-10-32, Elizabeth, dau,. of J. W. Martin.

ed. Addiscombe, 1826-7. Hodson, III (430).

11-12-29, appd. asst. to Gilmore on svy. of road Burdwān to Patna, completed by March 1830 [28]; 1-10-30, appd. asst. to Wilcox on svy. of Brahmaputra R., taking ch. Sept. 1831 [16, 515]. 1834-7, with GTS.

OSBORNE, Henry. Civ. Survr., uncov.

1815-6, arrd. Calcutta as purser of ship *Mangles*; lived at 66 Dharamtalah.

As J. XIX. 1825 (840, 868), his wife and two daus. left Calcutta to join *Resource* for England, but Mrs. Osborne d. 3-1-25 at Kedgree, on Hooghly R. Had two sons with him as survrs.; the yr. named William, d., Calcutta, 16-8-34.

1817, emp. by Collr. 24-Parganas, and assisted by elder son, who left India about end of 1821.

SG. writes to Collr., 11-2-19, "Mr. Osborne has taken away his little boy from this office; he said he could find employment for him with himself, & as I had no vacancy, & could make no provision for a youth of his age, I made no objection" [368].

In an appn. to the Collr. of Bhulua, or Noākhāli, for the svy. of the islands and *chaurs* of the Meghna R., Osborne writes, 26-10-21, that "during the time I have had the honour to hold an appointment in the Honourable Company's service (nearly 4 years) as a surveyor in the department of the Collectors of Calcutta and the 24-Pargunnahs, I have...[employed] my leisure time in such a way as to increase the... comfort of my family, to which my salary alone was inadequate [12-3]. ...

"By making surveys and estimates, drawing plans, &c., for individuals, and...by an appointment as Assessor to one of the Divisions of Calcutta, I have been enabled to average an addition of about 300 rupees monthly during the last 12 months, with hopes of an equal or greater advantage in future, according to...my becoming more known. ... I should certainly prefer a permanent salary...under Government, even if something less than what I now realise"[1]. He was not attracted by the terms offered, and the svy. went to Blake [138, 425], Osborne retaining his post in the 24-Parganas. The elder son, a "young man of high character & very promising talents", had been proposed as his successor in Oct. 1821, but Govt. sanction was not received till Aug. 1823, by which time "he had been at length induced, about eight months ago, to accept an offer to embark on board a ship bound to Europe". Osborne thereupon offered his "younger son Wm., who was duly appd. on Rs. 100 pm. [368-9].

Of maps by Henry we find record of one of Dum Dum Cant., 10-3-19, and one of Calcutta. Another of Calcutta "with latest improvements" by Wm., 4¾ inches to mile, was engraved[2]. During 1826 Wm. was on a svy. of Chinsura [368-9], and in Dec., being dissatisfied with his monthly terms, was struck off and paid by contract. During 1828 he survd. road "from Pultah to Deepa" and from "Deepa to Jungle Mehals".

1835, a Geo. Osborne, of the Opium Dept., compiled a map of Ghāzipur, but lacked funds for its pubn.—Nov.-Dec., 1837, when stationed at Chunār, he reported on the possibility of a coal fd. at Bijaigarh, returning with a map of part of Son valley. He was later stationed at Gorakhpur. This may have been a bro. to Wm.[3]

OTTER, Richard Fendall. Mad. Inf.
bapt. 18-11-03. d. 11-3-41.

Lieut. 7-4-20; Capt. 4-1-32; ret. 22-7-40.

Son of Capt. John Otter, of RMC. Sandhurst.

ed. Sandhurst.

MGO. 7-9-27, appd. Asst. Survr. 2nd cl.; DDn. 222 (194), 21-11-27, arrd. Madras, Oct., to join Vizagapatam svy. before party took field.

Not a success, Snell reporting, 1-7-29, "that he has not made any progress...during the last month, on account, as he states, of incessant rains, although from reports of the Assistant Surveyors employed in the same quarter interruption from this cause has only lately occurred"[4].

DDn. 237 (179), 5-9-29, asked leave to resign "as, from the experience of the last season of the *field* survey, I find myself *constitutionally* inadequate to the severe bodily labour... of the inferior duties of the Department". He was at the same time reported "absent without leave", and his previous season's work had shown a "total neglect of duty". His resn. was accepted[5] [102-3].

OVANS, Charles. Bo. Inf.
b. 20-9-1793. d. 19/20-7-58.

Ens. 25-7-09 ... M Gen. 20-6-54.

Son of David Ovans and Mary his wife, dau. of Chas. and Jane Lambert.

m., Tweedmouth, 25-11-34, Mary Robertson.

1816, or later, survd. passes into Berār [123], and 1816-20 on rev. svy. of Surat and Broach [170].

9-3-20, recd. for ch. of rev. svy. Kaira Dist.; BO GO. 23-11-21, promoted 1st. Asst. Gujarāt Rev. Svy.; with svy. till closed down, 1829 [343].

c. 1835-7, QMG. Bombay army; 1838, Resdt. at Satāra; captured by insurgents in 1844 whilst on tour, and imprisoned in Passhala fort, Kolhāpur State.

PALMER, Francis Charles. Ben. Cav.
b. Calcutta, 3-4-1792. d. Dacca, 24-10-25.

Corn. 10-9-08 ... Capt. 9-4-23.

Son of John Palmer (1767-1836), "Prince of Merchants" (*DIB.*)[6], by his wife Mary Sarah Hampton, said by Lady Nugent to have been of mixed blood; g. son of Maj. Wm. Palmer [I, 56].

m., Calcutta, 8-2-32, Miss Anna Elizabeth Burrows.

Hodson, III (446-7).

1-1-17, appd. DAQMG. MRIO. M 334 & 25 (69, 70), 1817, survd. routes Chunār to Mirzāpur and Hilia; "plan tells one story, and the field book another utterly at variance with it"; Everest, 1832.

PATON, John. Ben. Inf.
bapt. 11-4-03. kd. in action, Khurd Kābul Pass, 8-1-42, during retreat.

Ens. 10-6-19 ... Capt. 16-7-28; Bt. Maj. 23-11-41.

Son of Peter Paton, merch. of Fraserburgh, and Agnes his 1st wife.

Hodson, III (475).

27-11-23, appd. DAQMG., 3rd. cl.; 1825, with QMG.'s Dept., Arakan [337]; leave on mc., Calcutta, Dec. 1825 to Aug. 1826.

1827-8, on road svys. N. of Delhi; plans of Karnāl, Ludhiāna, Sahāranpur cants. 1827; 1828, DAQMG. 2nd. cl. [27].

MRIO. 83 (53); svy. in Jodhpur State, und.

Afghān war, 1839-42, QMG.'s Dept; 1839, sketch of route Kandahār to Giriksh.

PEMBERTON, Robert Boileau. Ben. Inf.
b. 21-6-1798, W. Indies.
d., Berhampore, 26-6-40; MI.[7]

Lieut. 1-8-18; Capt. 21-7-35.

[1] BTC. 23-11-21 (25). [2] *Ben Regr.* 98 (281), 88 (25, 22) ib. 114 (453); *Cal. Rev.* IV. [3] Collr. Ghāzipur to Comnr., Benares, 21-1-36, DDn. 345 (19-21); *JASB.* VII, 1838 (839-48). [4] DDn. 237 (67). [5] ib. (189), 2-10-29. [6] Founder of the Hyderābād firm, Palmer & Co.; Pankridge (51). [7] *Ben. P & P.*, I (98).

Son of Rev. John Butler Pemberton, barr., rector of Trinity Ch., St. Kitts, WI., and his wife Harriet, née Boileau, widow of Richd. Price.

m., Calcutta, 7-4-32, Henrietta Peach, dau. of Duncan Macleod, Ben. Engrs. [I, 352]; father of M Gen. R. C. B. Pemberton (1834–1914); . CB; CSI; DG. Railways in India; also of J. M. Pemberton, surg. Ben. Med. (1835–67); a dau. m. Sir Geo. Udny Yule (*DNB.*).

DIB.: Hodson, III (496–7).

BGO. 15-7-20, granted 12-mo. leave for study at Ft. Wm. Coll.; ib. 3-1-22, to officiate as DAQMG. 3rd. cl., for employment under SG., who had specially recdd. him [332][1].

1822, Asst. Survr., Rohilkhand rev. svy. under Bedford [154, 333, 406]; Sept. 1824, on mil. service to Cāchār with Birnie Browne [427], making svys. of Barāk R., and of Manipur road [66, 151, 434][2].

Govt. Gaz., 7-7-25; letter from Pemberton, Manipur — volunteered to accompany Gumbheer Singh — left Sylhet 17th May — surveyed route to Munnipoor by perambulator, 96 m. from Banskandee.

Govt. Gaz. 4-7-25; "Lieut. Pemberton and Raja Gumbeer Singh arrived at Munnipoor on morning of 12th June, and took possession of the stockade evacuated by the Burmans. ... Lieut. Pemberton returned in the evening of 13th to the town to survey as much as possible of the valley during the Rajah's absence, which would last 4 or 5 days. On his return the party was to set out for Banskandee immediately".

BGO. 1-8-25, 2 mo. leave to Presdcy; Oct. 1825, to draw allces. as Survr.; Dec. 1825, returns to Sylhet, and till 1827, survd. tracks from Manipur to Kabaw valley via Tamu[3], and w. to upper Assam and Cāchār; attd. to Pol. Dept.; BSO. 13-6-28; "Adverting to...the services rendered by Lieut. Pemberton in the Political as well as the Surveying Department, and to the...trouble, privation, and extra expense, to which he has been exposed, ... the Governor General in Council considers that it will be equitable...to grant him compensation in the Political Department for the loss of his staff allowance as a Deputy Assistant Quartermaster General [336, 348]". Granted extra allce. of Rs. 250 pm. from Pol. Dept. from 7-10-25[4].

DDn. 231 (129), 24-1-29, SG. reports that he was "employed (also under the Political Department) in the exploration and survey of the country of Munipoor, or Cassay, and of the Kyan-Duan [Chindwin] River [437, 454]. Both Lieuts. Wilcox and Pemberton are officers of experience, and good oriental scholars, well versed in the customs and languages of the natives of India, and also possess high professional talents and skill as surveyors and practical astronomers. They have evinced themselves to be men of enterprize, and by their labours...our geographical knowledge of the countries east of Bengal has been much extended" [3, 78–9, 181–3, 199, 222].

Pemberton was, further, a beautiful dmn., witness specially MRIO. 136 (6).

1828–30, was member of comn. laying down Burma-Manipur boundary and, 1830, visited Ava; then to Arakan following Trant's route over the Yomas to An [71, 508], and survg. cants. at Kyaukpyu and Akyab[5]. He reported personally to the GG. at Allahābād, and was officially commended for his "determination, ... accustomed zeal and spirit of enterprize", which led him "to accept the call to Ava, and to set out forthwith, notwithstanding the unfavorable season of the year"[6] [66].

1831–2, deputed to select suitable site for capital of Arakan, and with Jenkins [454 n.5] survd. route from Arakan through Chittagong, Cāchār, Manipur, Nāga Hills, to Assam [454].

Offered svy. work under SG., but preferred pol. service on NE. Frontier, which included mission to Bhutān, 1837[7]; from 1839, AGG. Murshidābād till death.

Auth. of *Report of Eastern Frontier of British India*, 1835; *Report on Bhutan, 1839.* Constant contributor to ASB. of birds and geol. specimens[8]. His father-in-law writes after his death that he and Mrs Pemberton were engaged on a catalogue of his "Bhutan specimens".

PERRY, James [II, 436]. Mad. Inf.
b. Bath 12-6-1790. d. 5-9-63.

Ens. 27-6-06 ... Lt.-Col. 13-7-31 ... Lt.-Gen. 6-12-56.

m., 1st., Madras, 3-7-26, Elizabeth, dau. of Lt.-Col. Wm. Read, DQMG. HM. Forces in India.

m., 2nd., St. George's Hanover Sq., 18-12-50, Ida Sophia, dau. of Capt. J. E. Parlby, RM.

Oriental Club.

June 1807, MMI. cl. III [II, 320]; 1810–1, on Goa Svy. [II, 156 n.5]; 1812–5, to Europe on mc.

1817, with Hyderābād Subsy. Force; on svy. of passes in Nāgpur Territories under AQMG., completing materials by end Oct.[9] [84].

MGO. 2-2-19, appd. Asst. Survr. in Deccan [125 n.6, 212, 352]; submits resn., Dhārwar, 2-10-21; "For the most part of the time that I have been in monsoon quarters, I have been totally incapacitated from attending to my duty in consequence of a severe bowel complaint which I contracted whilst on survey last season, ... and...may be permitted to visit the sea coast for the benefit of my health...[and] to rejoin my Corps"[10].

PESTER, John. Ben. Inf.
b. 22-12-1771. d. 1-8-56.

Ens. 5-9-1800 ... Lt.-Col. 16-12-24; ret. 6-1-26.

Son of Emanuel and Peggy Pester.

m., Montacute, Somerset, April 1811, Elizabeth, dau. of Rev. Wm. Phelips.

Hodson, III (511–2).

MRIO. M 518; 60 (15, 20); journals and well-drawn sketches through Surguja and Mirzāpur between Son and Narbada, whilst in ch. Guides and Intelligence. "Map of the outposts and line of south western frontier occupied by Brigadier Gen. Toone's Division" not so accurate or complete as Robt. Smith's map of same area [II, 47].

Extracts from Pester's diary, kept whilst Bde. Maj. with force that captured Gwalior 5-2-04, pub. under title *War and Sport in India, 1802–06.* ed. by his gt. nephew, J. A. Devenish, late of PWD., 1913.

PEYTON, John. Sub-Asst. Survr., GTS.
b. *c.* July 1804 in India.

Sub-Asst. 1-10-23 ... Dep. Compr., GTS., 18-1-32; 1st. Pricpl. Sub-Asst., 1844; Ch Civ Asst. 18-5-48; ret. April 1856.

2nd. son of Wynne Peyton (d. 1848), Supdg. Surg., Mad Med.[11].

30-9-23, sd. indenture as appce., GTS.

He was appd. in place of young Wm. Lambton [326–7, 379–80], his father being a friend of Everest's

[1] DDn. 196 (143), 6-11-21. [2] The original plan that Shuldham's force should strike into Burma via Cāchār and Manipur was soon abandoned; Bhuyan (546). [3] Kabaw Valley; 14th Army, 1943–5; "Death dripped from every leaf"; *Elephant Bill* (140–1). [4] On transfer of the Rev. Survrs. from QMG. [333]. DDn. 219 (246) & 230 (340–1). [5] MRIO. 191 (1–6). [6] HMS. 672 (615). [7] *JRGS.* VIII, 1838 (391–7); *v.* Ashley Eden's *Political Missions...to Bhutan*; 1864. [8] *JASB.* VIII, 1838 (90); X, 1841 (66–7) XII, 1843 (255). [9] DDn. 142 (69), 7-3-17; MMC. 24-9-17. [10] Bo MC. camp, 59/1822. [11] Asst. Surg. 1791; Surg. 1799; ret. 1826.

at Hyderābād [444]. "I entered the G.T. Survey", he writes later, "in 1823 and served under you until your departure to England in 1825. ... I assisted in the operations...from Pilkhur to Seronj, through the deadly tracts of the Mahadeo mountains [242–6, 403–4]. I was then employed on the longitudinal series with Mr. Olliver, Mr. Rossenrode, and Mr. Torrick, at that time the only unconvenanted Trigl. surveyors besides myself.

"I need not dwell on the hardships and difficulties we encountered on that service, nor on the successful termination to which it was brought [261–4, 382, 404.5, 492]"[1].

PRINSEP, James. Assay Master.
b. 20–8–1799. d. 22–4–40.

Asst. Assay Master, Calcutta 1819—Assay Master, —Benares, 1820–30—Calcutta, 1830–8 [435].

7th son of John Prinsep [1746–1830], merch. of London and EI. Agent, who sent 8 sons to India.

m., Calcutta, 25–4–35, Harriet Sophia Aubert.

FRS.

DIB.; Laurie *JASB.* IX, 1840 (336–7) Markham (242–3); marble bust, ASB. Calcutta now with VM.; Foster (79, 81) records; plaster replica, and medallion portrait. Portrait by Colesworthy Grant, *Public characters of Calcutta*, (pub. occasionally) *c.* 1830–50.

appced. at HM. Mint, London, arrd. India 1819.

1822, made svy. of Benares city, 8 inches to mile. Copies "made for various public officers—Rs. 1,000 paid to Mr. Prinsep as remuneration—Mr. Prinsep has received from England a lithographic edition, ... rendered more complete with supplementary additions—Government have purchased 12 copies @ 12 rupees a copy"[2].

1823, *As R.* xv. appx. I (1) describes obsns. for lat. of Benares made by Wm. Cracroft[3] and James Prinsep in Nov.; they discussed obsns. made by Burrow, Crawford, Wilford, and Hodgson, and deduced value of 25° 18′ 33″ for the "Hindu Observatory in the city". They also discussed the value of long., with those supplied by Ewer [446], Colvin [205 n.7], and Maxwell[4].

1827, completed map of Allahābād, left unfinished by Irvine [462], in spite of "the difficulty of absenting myself from Benares for more than two or three days at a time"[5].

A pleasing artist; pub. album entitled *Benares illustrated in a series of Drawings*; Calcutta & London, 1831. sketched meast. of Calcutta base-line, Jan. 1832 [IV, pl. 2].

Phil Trans. 1828, (79–95, 251–5); papers on meteorl. journal kept at Benares and meast. of high temperatures.

Asstd. Herbert in producing *Gleanings in Science*, becoming editor in 1831 on Herbert's move to Lucknow [458, 491]. Changed title to *Journal of the Asiatic Society of Bengal*, the 1st number appearing 7–3–32. Succ. H. H. Wilson as Assay Master at Calcutta in 1832, becoming Sec. of ASB. [510].

JASB. VII, 1838 (xi, 916); ASB. records his sailing from Calcutta, Nov. 1838, expecting absence of 2 to 3 years. Resn. as Sec. refused; "It is now 19 years since Mr. James Prinsep arrived amongst us, a boy in age, wanting perhaps the finish of classical scholarship which is conferred at the public schools and universities of England, but well grounded in chemistry, mechanics, and all useful sciences.

"He came...as assistant to Dr. Wilson in the Assay Office at Calcutta [312 n.7], but after a...little more than a year was removed to Benares, to take independant charge of the same department in the Mint of that city. At Benares he remained for nearly ten years, during the better part of which he superintended also works of improvement in the city. ...

"Upon the Mint of Benares being abolished in 1830, he resumed his post in Calcutta, and was soon after employed in completing the canal and locks to connect the Hooghly River with the Salt Water Lake and Sunderbuns, which had been commenced by a brother [*inf*][6]. ... Soon after this, Mr. Wilson returning to Europe, Mr. James Prinsep found it necessary to confine himself to...the Assay Department.

"After fighting fruitlessly against the approaches of disease for a couple of months, he was at last compelled...to quit the country suddenly, ... in the early part of...November" 1838.

Devoted several years to study of archæol. inscriptions resulting in successful deciphering of those on Asoka pillars, which, writes Markham; "had baffled the scholarship of Jones [I, 342] and Colebrooke [II, 386]. ... The clue was first obtained when, in June 1827, Prinsep received copies...of sentences cut on the pillars round the famous Sanchi tope or mound near Bhilsa in Central India. Each sentence ended with the same two letters, and it occurred to Prinsep, by a sort of inspiration, that these two letters represented the verb "to give", or "a gift". It was thus that he finally obtained a clue to the alphabet. ... He applied this alphabet to the...pillars at Delhi and Allahabad, and the great discovery was completed. They all proved to be a series of edicts by the famous Buddhist King, Asoka".

Markham adds that Prinsep was "a man whose equal has rarely been found in acute reasoning and unflagging industry, backed by an enthusiatic love of research. He added to rare gifts of intellect an amiable and generous disposition, giving all credit to his fellow labourers, and reserving none for himself"[7].

Auth. of *Essays on Indian Antiquities*, ed. by E. Thomas; 2 vols. Murray, 1858; at beginning of which is a bio. notice by one of his bros.

Prinsep's Ghāt in Calcutta is named after him.

PRINSEP, Thomas. Ben. Engrs.
b. 15–9–1800. d. Calcutta, 24–1–30, from riding accident; MI. S. Park St. cem.

Lieut. 5–9–23; Capt. 28–9–27.

8th son of John Prinsep, and bro. to James [*sup*].

m., Calcutta, 18–2–29, Lucy Anne, dau. of Robt. Campbell, of Calcutta; she d. 13–3–91, aged 83.

ed. Addiscombe, 1816–9. Hodson, III (578).

BTC. 16–3–21, appd. Survr. to Sundarbans Comn. [7, 141–4, 305, 369]; B to CD. (Rev.), 30–7–23 (231–50), appd. Asst. to Supt. of Canals; 1824, Survr. to Comnr. Salt Chokies [138, 141–2]; 1824–6, mil. service in Arakan [333].

BGO. 30–10–26, appd. Supdt. of Canals in succession to Schalch [13–4, 500]; prepared several important maps—MRIO. 170 (40), *Survey of the Salt Lakes or Marshes adjoining Calcutta*, shewing the connection with the different canals and tide creeks; Dec. 1828; ... 2″ = 1 m.", covering Baranagar and Dum Dum, s. to Tolly's Nullah—MRIO. 43 (26 A), *Plan of the City of Calcutta and its Environs*, ... with additions...by Capt. Prinsep"; engraved [13].

IO. Cat. (191) "*Map of the Suburbs of Calcutta* E. of Circular Road, ... 1830; ... 4 inches to a mile"—*E. Canal, 1827*, with properties along banks "...drawn by Mr. Turner"; 125 ft. to inch; *Ben Regr.* 36 (110) —"*An Atlas of the Ganges* and its outlets, from

[1] to SG. 22–7–41, DDn. 403 (432). [2] B to CD., Jud., 10–4–23 (186); ib. 7–12–26; original MSS. at IO., Foster (76); *Ben Regr.* 190 (144–5). [3] (1787–1846); BCS.; Offg. Judge, Benares, 1823. [4] Hamilton Geo. Maxwell (1787–1829); Ben. Inf. 1805–29; Adjt. Champaran Lt. Inf. 1813–9. [5] Prinsep to Jud. Dept. 20–5–27; DDn. 203 (62–6); Map MRIO. 184 (24). [6] cf. *Ben. Sel. Canals* (90). [7] Markham (242–8).

Allahabad to Calcutta, 6 [or 8] sheets, scale 2" to m.; lithographed" [15-6, 299, 448].

Auth. of *Steam Navigation on the Ganges*, c. 1826.

RAVENSHAW, William. Mad. Engrs.
bapt. 21-2-1781.
d. on bd. *Castell*, Madras Roads, 15-2-25.

Ens. 30-1-1796 ... Capt. 15-11-10.

Son of John Goldsborough Ravenshaw, and Elizabeth, his wife, dau. of Col. Withers.

1817, Supdg. Engr. Malabar & Cochin; sold survg. insts. to Svy. Dept., Madras [215-6].

1822, prepared *Plan of the Town of Madras*, and its limits "for the use of the Justices in Session"; Civil Engr. at Presdcy. [99].

REES, Vincent Louis. Compr. & Sub-Asst.
b. Berne, Switzerland, c. 30-11-1794.

Arrd. India c. 27-11-21.

Compr. 15-1-25; Sub-Asst. SGO., 21-1-25; leave to Europe on mc., 1830-2; in ch. SGO. obsy. 10-1-35; left India on ret. 9-10-52.

m., 1st., Calcutta, 2-6-25, Sophia, only dau. of the late J. B. Plusker; father of W. Palmer Rees, who m., Calcutta, 29-9-54, Mary Ann Mallock.

There was another Vincent Rees, asst. to Carr, Tagore & Co., brokers, who pr. m., Calcutta, 14-2-38, Eliza, eldest dau. of the late Jas. Jones, of Ireland, and d. Calcutta, 24-5-45, aged 34.

Before 1820 held comn. in militia of Berne canton.

DDn. 204 (135), 8-1-25, Blacker recds. his appt. to assist in astr. obsns. at SGO.; "of a respectable education and class in life. ... As he has for some time been working gratuitously in this office in order to recommend himself, I have had an opportunity of making myself acquainted with his merits and capabilities [188].

"Mr. Rees is a Swiss gentleman by birth, and has resided during four years in Calcutta, employed chiefly as a teacher of elementary mathematics and English grammar, in which he is...proficient".

Appd. Sub-Asst. on R 240 pm. [313].

Everest records further particulars; "Mr. Rees...had a fair prospect of independence before him, which he only relinquished on Colonel Blacker's repeated assurances of protection and support. ... Messrs. Bonasse & Co., of this city, to whom he brought out letters, and in whose house he resided for some time, offered him a respectable situation in their counting house, with the promise of eventually admitting him to a share in their business.

"Preferring, however, the service of a Government whose... liberality towards their servants he had always heard eulogised, he declined their proposal. ... At the time Captain Herbert made the application in his favor, he had the sum of 40,000 rupees in his Agents' hands (Messrs, Palmer and Co.). Had he been fortunate enough to have obtained leave, ... he was prepared...to draw out of their hands, and take to Europe, the whole of his money. By the failure of that house which occurred soon after [471 n.1], he was left entirely dependent on the bounty of Government. ...

"He was uniformly treated by Colonel Blacker with ...attention, having an apartment in his house, and a seat at his table. Indeed...he originally proposed...that Mr. Rees should be appointed to succeed Captain Cheape, who was then Assistant to the Surveyor General" [310, 433]. ...

"On Colonel Blacker's death, ...Major Hodgson... deemed it proper to employ Mr. Rees in a totally different kind of duty, viz., that of instructing the apprentices in the Revenue Department in the practice of surveying [365]. The season of the year chosen for carrying on these lessons was the months of May, June, July, and the consequence to Mr. Rees of constant exposure to the excessive heat...was a paralytic seizure, which has entirely disabled him from writing with his right hand, affecting his speech in a considerable degree, and also deprived him of the free action of one of his legs and arms. ...

"Finding after several years that his symptoms were in no degree improved, he was induced by the advice of his medical attendant to submit his case to Captain Herbert...for leave of absence...to visit his native country. ... Some difficulties having been anticipated from the want of a precedent, Mr. Rees still remains...endeavouring to perform his duties. ... As there is a probability that Mr. Rees' malady may be benefitted by a visit to his native country, I would recommend that he be allowed to be absent...without being struck off the strength of the establishment"[1].

On his return from leave in 1833, Everest employed him in the obsy. at Calcutta [186-9]; "Mr. Rees was an invalid when I arrived. His face was paralysed; he had lost the command of his right arm, and wrote constantly with his left hand. He wrote so badly that it was difficult to read his writing. He does so still, and...I conclude that he is not restored to health and efficiency. Mr. Rees' right arm is subject to violent convulsive motions. He had, in fact, no controul over that member, and with the best intentions in the world might have done incalculable mischief amongst the valuable instruments of my department. ... I deemed him, and do still deem him, not only useless, but dangerous, about instruments"[2].

Suitable work was found for him at the SGO. until he ret. in 1852.

REMON, Thomas [II, 438]. Bo. Engrs.
bapt. 22-12-1790.
d. 5-11-25; Māndvi, Cutch; MI.

Lieut. 1-10-08; Capt. 16-8-19.

Son of James Remon, of Jersey.

From 1812, asst. on rev. svy., Bombay I—1815-6, on svy. with fd. force in Gujarāt [123]—again with rev. svy. Bombay till, BO MC. 8-1-18, "ordered to proceed on field service in the Concan"—wounded at capture of Kooree fort, 13-3-18;[3] BO GO. 14-4-19, planned successful attack of hill fort of Bhūj, Cutch—*Bo Gaz.*, 14-11-25, "distinguished on account of his ardent zeal and high professional acquirements" —d. "of a bilious fever...on his way from Kaira to take command of the Engineers of the Field Force in Cutch".

1830, "Routes in Goojarat, Ookamundel, and Choor Waugur".

REYNOLDS, William. Bo. Inf.
b. 21-2-1798. d. Bombay 2-2-28; MI.

Lieut. 5-1-19.

Son of William Reynolds, attorney of Folkestone, bro. of Chas. Reynolds, SG. Bombay 1796-1807 [I, 378-80; II, 438].

m., 13-10-23, Amelia, dau. of the late G. W. Gillio, Bo CS. [490].

BO GO. 1-11-20, appd. to Gujarāt Rev. Svy., and employed as asst. survr., Kaira Dist. till completion 1824 [170 n.5].

RICHARDSON, William. Astronomer.
Asst. at Royal Obsy. Greenwich,
Aug. 1822 to 1845.

Originally a north-country blacksmith.

Observatory, 48 (1925); *R A S* (*mn*), II (25), Feb. 1830.

Emp. by Sir James South (1785-1867), astr., *DNB.*, proving a skilled obsvr. and compr.

[1] from SG. 23-12-30; DDn. 265 (103-7). [2] DDn. 286 (85), 10-10-33. [3] Vibart.

1828–30, asstd. Everest in preparation of his *Account of the Measurement of an arc of the Meridian* [242, 246, 257, 446] and introduced him to Henry Barrow [259].

1830, awarded gold medal of R A S.; declined appt. of Astronomer at Madras.

1845, dism. by AR., Sir Geo. Airy; "though acquitted of charge brought against him, which was in no way connected with his work at the Observatory, he was not re-instated".

RIDDELL, John [II, 439]. Mad. Inf. b. 3–5–1785. d. Madras, 1–9–18.

Lieut. 17–7–05.

Son of John Riddell, merch., sometime Provost of Glasgow, and his wife Elizabeth, sister of Archibald Campbell, who assumed his mother's name, Colquhoun, and became Lord Advocate, 1807–16.

ed. Glasgow Grammar Sch. and Univ.; matric. 1797.

April 1806, MMI., cl. II [II, 520]; 1807–11, on Lambton's svy. [II, 242–3]; 1814, AQMG., svy. branch [II, 245–6, 322].

18–10–16, recdd. by Mackenzie for ch. of svy. office at Madras, "on account of his professional qualifications, ... and particularly for his experience in the Trigonometrical Survey"[1].

MMO. 24–3–17, to act as adjt. 2/10th NI.

MMO. 19–6–17, appd. "to receive charge provisionally of the branch of the Survey Department remaining at Fort St. George...with a salary of sa. pagodas 70 per month [II, 333], exclusive of the difference between the half and full batta of his rank" [II, 321; III, 351]. Arrd. Madras from Vellore, 16–6–17, and took over ch. on 17th July, the day of Mackenzie's departure [4, 300, 316, 475].

It was some time before the appt. of "that excellent young man" was confirmed. Riddell himself writes, 8–9–17; "My first desire is to see your views fulfilled, and myself nominated a permanent assistant. From what I hear, no appointments in the survey department will be made at this Presidency. All arrangements are expected from Bengal, and it is to that quarter I must look for my advancement. High emoluments...were never my object but, at the same time, I have the ambition of not being outstripped by others, ... although I trust I have not the vulgar idea of measuring a situation to its salary"[2].

He writes, 15–10–17, of the appt. of an asst. to Lambton on the GTS. "I am not at all surprised that there are many candidates for the important situation of succeeding Colonel Lambton. But, ... if there is any chance of an Assistant remaining at the head of the Madras branch of your department, I should like, at all events while you are at the head of all, to have that situation. Should there be, which I should much regret, no chance of that situation being permanent, I would reckon that of Lambton's assistant and successor as next in honor[3]" [450].

Lambton had, indeed, at one time suggested his return to the trig. svy., but, on hearing of "the appointment of Capt. Everest as his Hd. Assistant on a salary of 600 rupees" [342–3, 442], Riddell commented; "They do things stylishly in Bengal, and I wish I had belonged to that establishment. As I have always said, I wished to continue under you, and now the prospect in the Geometrical Survey being cut off, it is all I have to look to"[4].

His appt. was eventually sanctioned under MGO. 16–6–18, when he was duly granted "the designation of "Assistant Surveyor General". There were no real grounds for Garling's resentment at Riddell's selection to this post before him, for it was a staff appt. only, carrying no seniority over that of a Survr. in ch. of a fd. party [316–7, 339, 450].

He thanks Mackenzie for pushing his case, and "for the trouble you are going to take about me. I trust the Government here are now convinced of the necessity of the appointment, but I see that while Mr. Elliot [478 n.11] remains, I can expect only to be tolerated. I am completely in the background with him, and although I have shewn him every respect in the way of visiting, etc., have not received from him even the common civilities due to all. On the contrary, on occasions where every officer on the staff has been asked to dinners given expressly to the staff, I have been their only one at Madras left out. As you know me, you are sufficiently convinced that being released from long dinners is to me a favour, but there is a kind of pride of situation... that feels for being slighted. However, all the secretaries have behaved in a most friendly manner, and, as Governors are not permanent, I may survive the present one [317–8][5].

Later letters contain further news of Govt. Ho.; "Mrs. Elliott has been very ill; spasms the disorder she complains of"[6]. "The Governor & his family are as usual. Cards & suppers & bed divide their day. Another son arrived a few days ago from England, so the whole family are, I believe, now collected at Madras" [478–9][7].

Mackenzie loved hearing all the Madras gossip, and Riddell told him all the tittle-tattle [475–6]; "You ask for news from the Dekhan. ... We have allowed ourselves both in Berar & at Poonah to be lulled into a confidence which had nearly proved fatal to us. The discipline of our troops has carried us thro' satisfactorily, & must impress upon the minds of the inhabitants of India a great idea of our superiority in arms, whatever they may form of our abilities as politicians.

"At Poonah report says we were aided by the fidelity of one of our native officers. An attempt to seduce him had been made for the Peishwah. ... This, thro' his commanding officer, he discovered to the Resident, who desired him to carry on the plot. In the course of it he received 500 rupees, was introduced at the Durbar, & arrangements made that when the Peishwah commenced the attack [427], the battalion...should turn on their friends.

"The attack was made, and Gookla's astonished horse received a volley from the supposed conspirators. ... The officer has been rewarded by a gift of 5,000 in addition to the 10,000 he got in the course of the negociation by a jaghire"[8].

Riddell was amongst the officers consulted as to the probable value of the new Telegraph [270], and Mackenzie writes, 11–4–18; "Your report on the Telegraph has given much satisfaction here, & I am glad it was referred to you in that manner. Some other reports we have got on it are so loaded with technical terms as to be not very intelligent to plain ABC men, & are laughed at. Ever avoid technical phrases, except to professional men. ... You are a good fellow, Riddell, & have too much trouble for your pittance of pay. We must look to this when the Governor General comes down"[9].

Like many others of the Company's officers, he was a great reader, and he writes to Mackenzie, 8–3–18; "I understand books are very cheap at Calcutta. I requested you formerly to obtain for me the Asiatic Researches & Hume's History of England[10], with Smollet's and Adolphus' continuations[11], and if to be had at a very low price I would now add to that list the Encyclopedia Britannica & the Edinburgh Review. The former of these had been sold here for 100 pagodas & the latter [26 vols.] for 53 [451].

[1] MPC. 11–11–16. [2] DDn. 151 (31–8). [3] ib. (64–70). [4] ib. (85–100), 24–12–17. [5] ib. (105), 31–1–18. [6] Mrs. Elliot d. 1819. [7] DDn. 151 (46, 216); Sept. 1817; 15–6–18. [8] ib. (96–7), 6–12–17. [9] DDn. 156 (334, 341). [10] pub. 1754–61. [11] pub. 1757; 1802.

"You would be pleased at the commencement of our Literary Society. The whole merit of the undertaking is due to Babington"[1].

Amongst other scraps of news, Riddell writes, 9-2-18; "Col. Graham[2] leaves me tomorrow for Pondicherry. He is very unwell, poor man, & I am afraid not long for this world".

10-5-18; "It is again reported that Trapaud[3] is coming out, at which De Havilland is well pleased. Colonel Graham is again with me. He appears to have a great alacrity in running away from his wife, and I am not at all surprised at it. ... Marshall is to be Paymaster. Clive, Military Secretary. Berar has been given another Superintending Engineer, and Anderson is appointed, ... so that most certainly the Engineers have plenty to do, and no want of staff situations"[4].

The hit at the Engrs. referred to the original order that the svy. office should be handed over to the CE., and the reluctance of the Govr. to give it to anyone but an Engr. [317].

14-5-18; "General Trapaud is looking amazingly well. He has got a fine Europe colour, & apparent strength of body. He now stays at De Havilland's & I was hopeful might have taken your house [475, 477], but he talks of a bungalo"[5].

4-7-18; "The Engineer Department has returned to it's former state. Trapaud at the head, & De Havilland Superintending Engineer at the Presidency. The latter is pleased at the charge. You have lost two promising young officers— Davis [436-7] and Nattes[6]—of the death of the former you have seen the newspaper accts. The latter was killed at Mallegaown on the breach. He mounted it at the head of the Pioneers, & had merely time to see an inner wall & an intervening deep ditch. While he was making a signal to the storming party not to come, he was shot dead. The party, however, came on, but the scaling ladders were not long enough to get down the ditch, & from some mistake... they waited for orders to retire. Before these arrived, three more officers had been killed & several wounded.

"Headquarters, with the exception of Morison & Blacker, arrived on the 24th. All here are looking well. A levée numerously attended took place on Manday. The Genl. looks rather older, but his face is as red as ever[7]. Conway is thinner. He enquired particularly after you [II, 424 n.1].

"Genl. Munro [II, 433; III, 124] has given up the command of the force in the South Mahratta Country, & is on his way to Madras & England. This last campaign has almost cost him his eyes. They are so bad that he is still doubtful if he can recover the use of them. The other Coll. Munro is here from Travancore [109 n.4]. To him McDowall succeeds. Marshall becomes Paymaster & with much satisfaction resigns the situation of Secy. to Clive[8]. ...

"The Southern Mahratta Country is to be a kind of District & O'Donnoghue [II, 320] is appointed Qr. Mr. of Brigade in it. Chaplin is Head Collector & Commissioner [171], & Thackeray is in orders as Chaplin's successor at Bellary [171 n.8]"[9]. ...

Mackenzie replies almost weekly; 20-7-18; "The Peishwa being now our prisoner, I suppose tranquillity will be restored throughout. I see the arrival of Sir Th. Hislop mentioned, & the honours shewn; no doubt everything was magnificent & a fine speech made on both sides. So General Trapaud is arrived. I am glad he looks so well. I suspect he did not find England so cordial to his habits...as the Coast".

1-7-18; discusses Riddell's prospects; "I have sent your letter to Coll. Young, & I will acquaint you of what he says[10]. ... Perhaps I may meet him this evening at dinner at Lord Hastings'. He assured me of anything I can do for your cause. ... I am not to be dismayed. I wish you were a Captain on more accounts than one; but that will come in good time. Meantime, like the man in Montesino's cave— *Patience & Shuffle the Cards*[11]—a devilish provoking remedy tho', when a man's purse is low; but be not discouraged"[12].

Meanwhile Riddell was pulling other strings to get his appt. confirmed. He writes to Mackenzie, 13-7-18; "You remember, when I was placed under you last year, that I wrote home a full statement of the business to my uncle, Mr. Colquhoun, Lord Registrar of Scotland [497]. I gave an account of your plans, of my surveying services, ... and of the reported orders of the Court of Directors about Engineer officers, and ended by requesting him to use his exertions...to support my interest at the India House.

"He was...in London attending to his duty at Parliament[13] and he immediately made an extract...from my letters, and presented it to Mr. Canning[14], begging him to lay it before the Hon'ble Court. It was, accordingly, sent by him to the Chairman, and you have the substance of the answer. Nothing is there said about the exclusive claims of Engineers. ...

"The other letter...contains one also from Mr. Canning. ... By the same mail...he had written to Lord Hastings recommending me to his protection. I have enclosed it to Young...that, in co-operation with you, he may, when the Marquis receives it, not allow me to be forgotten.

"I have still to thank you as the author of all this, and I now begin to have strong hopes of being established as your assistant, and in charge of the Madras Survey Department. An increase to my income, ... with all my economy, ... will not preserve me from debt. I have been obliged nearly to give up society for, except for a few families, you know that Madras society is a regular Dr. & Cr. account and, as I cannot give dinners, I do not expect to get. ...

"I have no news. Jas. Taylor[15], rumour says, will be in Council. He and Dr. Stuart join me in remembrance to you, Mrs. Mackenzie, and Miss Bartel. ... There are, I am sorry to say, small hopes of Newman. He had lately a fever, and was, on its ceasing, sent...to Pondicherry and Cuddalore, merely for a change of air [312, 319][16]".

It is sad that the cruel climate was to claim Riddell so soon, 1st Sept. [318]. He took ill on 8th Aug., and writes on 13th; "I have all your letters and Mrs. Mackenzie's. ... Now I am on my back in bed, terribly reduced with a fever & dysentery, which has stuck to me for 14 days. Howard promises recovery". This letter is endorsed by Mackenzie "The Last", though he "had repeated intimation of his situation" [488].

He was deeply grieved; "My knowledge of Mr. Riddell was but late, only about 10 months ere I left Madras, ... but...I have had ample occasion to appreciate his great merit, his excellent disposition and discretion [318].

Writing himself about a class of survey apprentices, Riddell comments that "I am not very apt to lose my temper, a quality perhaps more to be considered than abilities in such an undertaking"[17].

Mackenzie was indeed well served by Riddell, as he was later by Mountford, and he writes to Young of the Mil. Dept.; "I am sorry to find...that the state of his affairs are not likely to promise anything to his friends in Europe. Indeed ...his residence at that Presidency was necessarily more expensive than his funds. ... If you are acquainted with his friends in Scotland, you will do me a favour by making my sentiments known. Very lately he had transmitted me a

[1] DDn. 151 (154); probably B. G. Babington (1794-1868); MCS. 1812-22; MD. 1830; FRS.; *DNB*. [2] James Geo. Graham; Mad. Inf.; Ens. 1781; M Gen. 1819; d., Dieppe, 1828. [3] Elisha Trapaud, Mad. Engrs. Ens. 1779; Lt Gen. 1814; CE. [4] ib. (173),10-5-18. [5] DDn. 151 (135), 9-2-18; ib. (203), 14-5-18. [6] John Wm. Nattes, Mad. Engrs., Ens. 27-7-11; kd. Malegaon 29-5-18. [7] Sir Thos. Hislop [83, 316, 401]. [8] Richd. Clive (1792-1831); MCS. 1808; nephew of Clive of Plassey. [9] DDn. 151 (213). [10] James Young, (1782-1848) Ben. Art. 1798-1818; MS. to GG. [11] Cervantes; *Don Quixote*, II, ch. 23. [12] DDn. 156 (374). [13] MP. Elgin 1807-10; Dumbartonshire 1810-20; d. 1820. [14] Geo. Canning (1770-1827); Presdt. Bd. of Control (India), 1816-21; Prime Minister, April-Aug. 1827; *DNB.*; *DIB*. [15] (1774-1852); MCS.; Bd. of Trade, Madras, 1816-25. [16] DDn. 156 (228-31). [17] to SG. 18-2-18; DDn. 151 (139-40).

letter from the Minister for India, of the 3rd March, to his relative the Lord Register of Scotland, with assurances of his support, and Mr. Canning had wrote to My Lord Hastings about him"[1] [340].

ROBB, Ferris Charles. Ben. Inf.
b. 24-2-1791. d. 23-1-55.

Ens. 20-8-11 ... Maj. 20-6-36; ret. 26-11-36.

Son of Charles Robb, RN., Master Attdt., Deptford Yard.

m., Calcutta, 15-1-27, Eliza, née Mercer, widow of Andrew Suter, Lieut. HM. 1st Ft. (R. Scots).

Hodson, III (662).

BGO. 29-1-21, "recently appointed to Quarter Master General's Department, to Cawnpore under DQMG. for survey of roads in Western Provinces" [37, 87]; as DAQMG. survd. a number of routes in Central India, and compiled map of upper Narbada, 1823-5.

10-12-25, mentioned in dispatches, capture of Bharatpur.

MRIO. 77 (6 a) map showing sites of Thug murders, 1832.

ROBINSON, James Jeremiah. Bo. Mar.
b. 1789/90. d. 17-4-26; MI. St. Thomas' Cath. Bombay.

Mdpn., 21-6-05 ... Junr. Capt. 1825/6.

1825, survd. s. Konkan coast, co-operating with Jervis, who writes; "My work, as it closes on to Captain Robinson's, exhibits a difference...I could have wished reduced. ... Captain Robinson's is far more correct than mine. ... He is a more experienced and careful observer, and obtained his results from a base which is only about a geographical mile south of Viziadroog [126, 130]"[2].

Apparently no relation to Geo. Robinson, also Bo. Mar., appd. 8-7-23, who served through Burmese War as mdpn. and Lieut.

ROSS, Daniel. Bo. Mar. & Indian Navy.
b. Port Royal, Jamaica 11-11-1780. d. Bombay, 30-10-49.

Mar. SG. from death of Chas. Court, Sept. 1821, till resn. Nov. 1833 [16-7].

Nat. son of Hercules Ross, of Rossie Castle, co. Forfar, who with 2 bros. made fortune in WI.; half-bro. to Horatio Ross (b. 1801) BCS., whose mother was dau. of John Parish, merch. of Hamburg Horatio won the first recorded steeplechase (of moonlight fame) on his horse "Clinker"[3].

m., Macao, China, c. 1809, Maria Rosa Theresa Pepin, a Portuguese lady, b. at Pondicherry 1793, by whom he had son, Wm. Hercules Ross (1811-49), Ben Inf., kd. at Chilianwāla 13-1-49, and a dau., Eliza, who m., Calcutta, 15-7-33, Francis Seaton (1808-37), Ben. Inf. Of their other 7 children two sons served in the Indian Navy, and two daus. m. bros., Richd. Lloyd, IN., and John Lloyd, RA.; Richd. Lloyd succ. Daniel Ross as Mar. SG.

A son of Francis Seaton, Francis Lambert, who also entered IN., adopted name Ross-Seaton[4].

Low, I; Markham (10)

FRS. Portrait in oils in rooms of Bo. branch of R As Soc. Family hold a large silver cup—"my American vase" of will pr. 22-12-49—presented by underwriters of New York for salvaging cargo of ship sunk off China coast in 1809.

MRIO. 102 (12), svy. of coast of S. China, 1807, being engaged there 1806-20.

1824-6, Burmese War in general direction of mar. svys. on Arakan coast [184]; 1827, at Amherst in *Investigator* [434]; 1830, on Arakan coast.

Described by Markham as "the Father of the Indian Surveys" and "the first who introduced a really scientific method" of coastal and mar. svys [433]; *JASB.* I, 1832 (202), memo. on "apparent time on board ship". From Nov. 1836—pension Rs. 350 pm.—"retired to Bombay, where he was Master Attendant, and President of the Geographical Society from 1839 until just before his death"[5].

ROSS, John. Ben. Med., local appt.
pr. b. c. 1788-9.
d. 15-2-18, camp, Nadia.

offg. Asst. Surg., 1817.

pr. 2nd son of Zacchaeus Ross, of Hawk, St. Thomas, WI. and thus related to Daniel (*sup*).

ed. Glasgow Univ.; matric. 1804; MD. 1811.

Crawford's *Roll* (B. 804); date of arrl. India not known.

Owing to the urgent mil. demand for med. officers during the Marātha war, Ross and 6 others were locally appd., pr. some time early in 1817, to do duty as Asst. Surgs. "during the existing exigency"[6].

In camp letter to Mil. Dept. 25-10-17 (108), Lord Moira nominated him to be Surg. and Geolgt. to GTS., being "singularly qualified for this task". He had been "strongly recommended to His Lordship's...notice by Dr Crichton, First Physician to the Emperor Alexander[7], ... as eminent for his attainments in natural science as well as in medical and surgical knowledge. ... Dr. Ross... adds a familiar acquaintance with the language of Persia (in which country he has travelled)". Ross had, moreover, "strong claims on the liberality of Government, in having...given his gratuitous services up the River to a distressed and sickly detachment of H.M.'s troops, who were deprived of all other medical aid". He was at the time, Oct. 1817, "on his way with a detachment to the Upper Provinces".

He d. whilst attd. to the Centre Div. of the army., pr. in med. ch. of troops.

ROSSENRODE, William [II, 352]. Asst. Survr. GTS.
b. 1-3-1792. d. Dehra Dūn, 9-9-52; MI.

Appce. 19-3-05; Sub-Asst. with Lambton, 11-3-07. Prncl. Sub-Asst. GTS. 28-3-35; ret. 31-7-41.

m., 1st. Masulipatam, 17-4-14 [II, 394], Mary Magdelene Cozvan who d., Calcutta, 21-3-34, aged 40; two of their sons John and Wm., joined GTS. 1838.

m., 2nd., Eliza, who survived him.

ed. at Obsy. Survg. School; well reported on Lambton [II, 346; III, 378-9]. After Lambton's death, being "a person of great worth, zeal, and practical acquirement, actually sent in his resignation" [223, 230 n.1, 373, 437, 439]. He agreed, however, to stay on, and on Everest's recdn. was promoted to Rs. 300 pm. from Nov. 1825 [9, 245-6, 325-7, 382, 444]. Had trouble with Everest over neighing horses [445].

1825-30, was Olliver's senior asst. on the longl. series Sironj to Calcutta, and did excellent work selecting stations in advance [261-4, 404-5, 417, 495].

RUDDELL, David. Ben. Inf.
b. 12-12-1786. d., Shirāz, 16-12-35.

Ens. 20-3-08 ... Capt. 13-5-25.

Son of John Ruddell, of Augha Common, Armagh, and Grace Bell his wife, sister of Chas. Todd Surg., Ben., Med.

Hodson, III (705-6).

Rāmgarh Batt. 1811-4; PS. to Lt. Govr. Java, 1815-6; Rāmgarh Batt. 1817-9; Ft. Wm. Coll. 1820-32.

1818, like other officers of Ramgarh Batt. [II, 47; III, 27, 88], survd. routes in Chota Nāgpur. SG. writes, 20-7-18;

[1] DDn. 154 (34), 27-9-18. [2] DDn. 182, M 194; S. Konkan Svy. 1823-4. [3] Horatio's g. dau. m. Maj. V. C. P. Hodson. [4] Left a son, Francis Daniel Ross-Seaton, 2nd Bo. Grndrs., from whom much of this infn. has been obtained. [5] Markham (10-11). [6] B to CD. 21-7-18 (227). [7] Sir Alex. Crichton (1763-1856); FRS.; Physician to Alex. I of Russia from 1804; *DNB.*

"The route in question must be interesting, as I believe it is altogether new; however, we shall see what the Qr. Mr. Genl. says upon it. ... If you could add a map...& take some observations of the latitude, they would add much to their value"

"Plan of Sumbhulpoor Fort" and routes were to be sent to QMG., who would pass them to SG. with comments [302, 335]; the plan of city or fort was to go to the CE. and not to the SG. "We are tied down by regulations & cannot deviate to the right or left. I wish with all my heart I had nothing to say to these roads or routes. Why don't you turn yourself to the taking of observations, & constructing a plan & map of the country of Sumbhulpoor? I believe it is a new field"[1].

RUTHERFORD, Henry. Ben. Art.
b. 6-12-02. d. Otago, New Zealand, 25-12-74.

2/Lt. 9-4-19 ... Maj. 3-7-45; ret. 5-7-46;
Hon. Lt. Col. 28-11-54.

Nephew of Capt. Wm. G. Rutherford, of Greenwich Hospl.
ed. Addiscombe, 1817-9. Hodson, III (710).

29-12-29 to 13-4-30, with Thos. Brodie, survd. Assam-Bhutān frontier drawing full allces. of land surveyor, Rs. 618 pm.[2] [64].

10-6-30, appd. Asst. to PA. Upper Assam, remaining on pol. duty in Assam till 1840, when he became PS. to Lt.-Govr., NWP.

SANDYS, Frederic Hervey. Ben. Inf.
b. 10-8-1791. d. 28-12-74.

Ens. 19-7-09 ... Lt. Gen. 8-2-70.

Son of Rev. Joseph Sandys, rector of Aghadowey, Ireland.
m., 1st., Cawnpore, 6-10-21, Miss Jane Culloden.
m., 2nd., Indore, 7-7-36, Maria Jane Bellasis, dau. of Wm. Nathan Wrighte Hewett, BCS.
Hodson, IV (17-8).

21-1-21, appd. DAQMG. 3rd cl.—BGO. 29-1-21, to Cawnpore under DQMG., for svy. of roads in W. Provs. [87]—ib. 20-6-25, promoted to 2nd cl. [337].

Oct. 1821 to Feb. 1824, survd. road Nasirābād to Jaiselmer; with map of "parts of Jodhpur, Jesselmere, and Oodypore; thence thro' Lagour back to Ajmere. The survey seems to be executed with care. ... Observations for latitude. ... It will form a good geographical material when longitude of Ajmere and one or two other points are better known"[3].

1834-56, PA. Mehidpur, CI.

SCHALCH, John Augustus [II, 440-1]. Ben. Inf.
b. 27-11-1793. d. 25-2-25, of wounds received in action on 23rd., Kiungpala, Arakan.

Ens. 22-2-09 ... Bt. Capt. 16-9-23;
"official" Maj. 16-9-24.

Son of Andrew Schalch, Capt. RA., from Switzerland, who was nephew of Andrew Schalch (1692-1776), master-founder of Woolwich Arsenal (*DNB.*).
ed. RMC., Marlow, 1807-8.
Govt. Gaz. 14-3-25, *ob.* notice; Hodson, IV (26).

1813-4, asst. survr. Murshidābād [II, 311]— Sept. to Dec., 1814, asst. on Sundarbans svy. [II, 17 n.2; III, 328]—1815, svys. with unit on Nepāl frontier [19].

BGO. 13-9-16, appd. asst., Sundarbans svy;—DDn. 142 (159), 11-7-17, to complete Wilton's svy. of Garo-Rangpur frontier [II, 457; III, 49]; "I am sure he will do justice to it", writes Hodgson—BGO. 23-6-18, granted 3 mo. on mc., with sea-voyage, leaving svy. incomplete till return [329].

1819, DAQMG. 3rd. cl.; BGO. 10-3-20, promoted to 2nd. cl.; ib. 21-2-23, to 1st. cl.

From *ob.* notice; "His father and some immediate relatives were officers of rank in our Royal Artillery, for which, or the Engineers, J. A. was originally intended—was sent to Marlow, but was removed on account of delicate health which handicapped him also later in life. ...

"It was recommended that he should proceed to India as an Infantry Cadet. Instigated by the example and kind assistance of Capt. Everest[4], now employed on the Trigonometrical Survey, he engaged deeply and successfully in mathematical, astronomical and other congenial studies. ... Under Colonel Crawford he still further improved himself [II, 193], and after having been actively employed under Capt. Morrieson in surveying the Sunderbuns [328] he was noticed, and kindly patronised, by the Marquis of Hastings, and obtained in 1819 a situation in the Quarter Master General's Department".

1820-4, emp. under Lottery Com. on improvement of Calcutta waterways, survg., laying out, and constructing the canals that have since developed into the present system [13, 495]. "He first became conspicuous at the Presidency, and...in the survey of Calcutta—in his...extensive canals—...his...iron suspension bridge and other public works—the well-known iron suspension bridge at Kali Ghat. Had never before been practically engaged in the slightest mechanical work"[5].

"The first iron bridge in India was a footbridge erected in 1822 over Tolly's Nullah at Kalighat. Span 141 feet, but only 8 feet wide, approached by a steep causeway, intended only for foot passengers and pack bullocks. This old bridge was pulled down in 1891, when a copper plate was found bearing the following inscription; 'Under the auspices of the most noble Francis, Marquis of Hastings, etc., Governor General and Commander-in-Chief of India, this Iron Bridge, the first of the description in India, is erected. Lieut. G. Aug. Schalch, Act. Mas. Mas. Anno Domini 1822; June 1st. Anno Lucio 5,226"[6].

Alexander writes of the Alipore bridge in 1826 that, "in proceeding towards Garden Reach, I passed an iron suspension bridge, the design of which is light and elegant, although *it is a great deal too narrow* to admit of carriages passing each other without considerable risk"[7].

His svys. of Calcutta were compiled into maps on various scales [14-5], which were not superseded till 25 years later, whilst his work on the canals was fully discussed and appreciated by the coms. of 1865 and 1904 [205]. He commented on the many projects for improving nvgn. between the Hooghly and the Ganges in "a pamphlet of 19 folio pages—*Plan for opening water communication from Calcutta to the Upper and Eastern Provinces of India*—Major Schalch does not like the proposals to keep the passage from Ganges into Bhagarathi open by means of dredging straight cuts; it would be impossible to keep them open for any time [I, 64; II, 20-1]. ... He recommends a new canal running across the line of the rivers to take the place of Tolly's Nullah, which can no longer compete with the traffic, and he sketches the course that was subsequently followed by the canal which runs east from the Hooghly just above Chitpore—the Eastern Canal—and estimated the cost. Government sanctioned the project, and engaged in the execution of it", till stopped by the outbreak of war with Burma[8].

[1] DDn. 156 (137-8) from Mackenzie. [2] BTC. 5-8-33 (6). [3] DDn. 309 (90), 27-6-32. [4] pr. before Everest went to Java [II, 137]; Schalch was a keen astronomer in 1813. [5] *Govt Gaz.* 14-3-25. [6] Blechynden (88). [7] Alexander (54). [8] *Gleanings in Science*, II (36-8).

On the outbreak of war—BGO. 16–8–24—a corps of Pioneers and Surveyors was raised at Chittagong under Schalch's comd., and placed under the orders of the QMG. [68, 333, 435]. His officers were scattered from the Assam valley and Cāchār to Arakan. After starting them off with general instructions [53, 181, 198–9], Schalch himself undertook the fixing of main control points in Arakan, but lost his life on a naval recce. up the Kaladan R. [182].

"Major Schalch, ... having organized a pontoon system for the use of the army in Arracan, was appointed to the head of that department. His health having suffered, he was recommended to try the sea air, and he accordingly proceeded in the Research with Commodore Hayes [68]. In the unfortunate attempt which was made against the stockade of Chamballa he was mortally wounded, and, having lingered in great pain, the following morning breathed his last"[1].

A more detailed account is given by Low, who describes the "action...up the Prome Pura Khione, or branch leading from the Oratung R. to Arracan [182 n.1], with a squadron consisting of the Research...with the gunboats and other vessels. At 2 p.m. they came within sight of the enemy's works at Chamballa, which opened a heavy fire on the leading vessels. The Research, with the Commodore on board, was soon within half-pistol shot, and commenced a heavy cannonade and fire of musketry upon the stockade. After a severe engagement of two hours, ... the tide beginning to fall, Commodore Hayes was obliged to drop down the river. ...

"The casualties were severe. Amongst the killed were... Major Schalch, a distinguished officer of the Company's service, ... who was on board the Research for the recovery of his health. He was struck while standing on the poop by a musket ball in his breast, and died on the morning of the 25th. ... On receiving his wound he fell into the arms of the Commodore, exclaiming 'I am a dead man', but lingered for two days in excruciating pain, imploring the bystanders to shoot him through the head, and put an end to his suffering. This action took place 23rd February 1825"[2].

For his work on the waterways of the Hooghly and the Sundarbans, Schalch had purchased a schooner *Dragon*, which he took with him for service in Arakan, "Government giving him a fixed monthly allowance of sicca rupees 800 to find himself in such conveyance. In August 1825 the *Dragon* was purchased by Government, and added to the Arakan division of the flotilla[3]" [489].

It was comdd. by Horatio Nelson and Drummond notes that the *Dragon*, "having been employed for the conveyance of the instruments belonging to the Survey Department, is to be considered as entertained from 26th February last, as a public vessel"[4].

For the dredging of the canals he had the *Pluto*, one of the earliest steamboats to be used in India, which was used as a floating battery during the Arakan campaign[5].

Schalch was most popular as well as talented. He had quickly won George Fleming's regard [II, 397], and it is recorded that "he was no common man, who, at his age, and as yet a subaltern in his regiment, so recommended himself as to obtain...the brevet rank of Major, and this without exciting the dissatisfaction of many who might...have thought themselves aggrieved by his advancement"[6].

SCOTLAND, David. Mad. Inf.

b. 22–11–02. d. 16–6–57.

Ens. 13–2–21 ... Bt. Maj. 9–11–46 ; ret. 22–10–47.

m., Dumferline, 24–7–38, Jane Stenhouse, dau. of Geo. Meldrum, of Dumferline ; she d., India, 1–4–30.

1826, with pol. dept. Moulmein ; survd. route "from British Cantonments at Moulmein to 3-Pagodas", 29–12–26 to 23–1–27[7] ; journal DDn. 240, M 420.

Name wrongly given by Grant as Scott [76].

SCOTT, David, senior. BCS.

b. 14–6–1786. d., Cherrapunji, 20–8–31, unm. ; MI.

Son of Archibald Scott, of Usan, NB. and Margaret Chalmers his 2nd wife.

Writer 21–8–01 ; Comnr. in Cooch Behār & Joint Magte. Rangpur, 27–9–16 ; Civ. Comnr. of NE. Rangpur, 1–1–22 ; AGG. NE. Frontier, 14–11–23.

DIB. ; Adam White ; PRIO. XIX (27–61).

1801–4, at Ft. Wm. Coll. ; from 1805, Collr. or Magte. successively, Gorakhpur, Purnea, Midnapore, Tipperah ; Dec. 1813, Judge & Magte. Rangpur Dist., and responsible for pol. relations with Assam [49].

1822, recce. svy. Garo Hills embodied with Schalch's svy. of 1817–8 into map of Goalpara, MRIO. 34 (12), of 1845.

1823–4, as AGG. for NE. Frontier, took pol. ch. in Sylhet and Cāchār on invasion by Burmese [50, 64], and did much to assist in geogl. exploration, taking keen interest in source of Brahmaputra [16, 52–3, 55–7, 63, 182, 423, 431].

April 1824, on assembly British forces at Gauhāti [52] marched from Sylhet over Jaintia & Khāsi Hills to Nowgong, and down Kalang R. to Gauhāti ; route survd. by Blechynden [51, 425].

From 1825, started rev. svy. for settlement of revenues Assam valley, using Bengali *amīns*[8] ; svy. supervised by Bedingfield with Mathew as asst., till Mathew took ch. after Bedingfield's murder [64, 146, 349, 423, 484]. Scott had only just left Nongkhlao for Cherrapunji when the disaster occurred ; he d. two years later at Cherrapunji, where Govt. erected a monument to his memory[9].

SCOTT, David, junr. BCS.

b. 10–10–1790. d. Boulogne, 20–3–1856.

Writer, 12–7–07 ; on deputation to Sundarbans, 1–11–14 ; Actg. Collr. 24-Parganas, 13–9–15 ; Comnr. in Sundarbans, 5–7–16 ; ret. 14–2–38.

Son of Capt. Wm. Scott, RN., of Logie ; no relation to above.

m., 2–6–25, Mary Anne, dau. of Wm. Crawford, MP. of Dorking.

Not a survr. ; 1814, first appd. to settlement work in Sundarbans, basing his work on Morrieson's svy. [141] ; 5–6–16 to 1817 Comnr. in Sundarbans ; "Mr. David Scott, relieved from Collectorship of Cuttack, and...well-qualified, both by previous experience...and by his general character as a Revenue Officer, to discharge the functions of a Commissioner in the Sundarbans, we appointed him to that situation"[10].

SCOTT, William [II, 441]. Asst. Rev. Survr., Madras.

b. *c.* 1784/6. d. Calcutta, May 1827.

Appce. 1–9–1798 ... 1st cl. Asst. Survr. 1818.

m., Madras, Nov. 1810 ; in 1840, his aged wife was supported by their eldest son, Wm. Henry Scott, who was hd. dmn. SGO., 1828–62. A younger son, G. H. Scott, was writer in fd. office at Dehra Dūn from 1835.

[1] *Gleanings in Science*, II, (39). [2] Low, I (437). [3] from John Hayes, Master Attendant's Office, Calcutta, 18–1–27 ; DDn. 220 (201). [4] Arakan, 21–6–25 ; DDn. 213 (30). [5] Carey, II (18). [6] *Gleanings in Science*, II (39). [7] Crawford, II (60, 64). [8] Thomas Jervis ; Annex. 2 (6–7). [9] Pemberton (223) ; *Ben P & P.* pl. facing p. 206. Khāsi chief at Cherra had in 1829 granted land for British sanatorium ; *NE. Frontier* (24). [10] B to CD. (Rev.), 1–11–16 (65).

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June 1801, joined Warren on Mysore svy., and, Oct. 1802, with him to Lambton's svy.; remained with Warren at survg. school, and when school was abolished, 1810, attd. to SGO. [II, 352 ; III, 373].

"In January 1816, I was detached, in conjunction with Mr. Hamilton & other junior assistants, to survey the districts of the Masulipatam Collectorate [99–100, 339, 373], on which service I received notice of my transfer under this Presidency [Bengal], with orders to proceed to Calcutta, which I reached in March 1818, & from which time I have been generally employed in the drawing department & in the instruction of surveying pupils [101, 312, 360]"[1].

During season 1818–9, his class of pupils survd. Botanical Gdns. Sibpur [12, 361]; Jan. to Aug. 1821, took ch. of pupils on svy. in Cuttack Dist.; DDn. 147 (202), 28–5–21, reports that he is suffering from "an obstinate complaint of dropsy, or swelling of the body" [19, 361–2].

Continued at Calcutta from Aug. 1821, drawing extra allce. Rs. 150 pm. as *instr.*; 30–4–23, "health much impaired"; with RSG. to Fatehgarh, salary Rs. 323 pm., returning to Calcutta, 31–7–26.

SEELY, John Benjamin. Bo. Inf.
b. 9–10–1786. d. Colāba, 20–12–26.

Ens. 26–3–09 ... Capt. 1–5–24.

Son of John Seely of London.

m., Calcutta, 5–2–13, Maria, dau. of Geo. Dowdeswell, Ch. Sec. Ben. Govt.

Auth. of the *Wonders of Ellora*, and *A Voice from India*, both pub. London, 1824.

Com Cor. 25–5–25, recdd. "further extension of his leave for 3 months that he may complete a geographical work on which he is engaged"; ib. 15–7–25, advanced £60 for return to India; ib. 24–8–25, permitted to return to duty.

London, 1826; "*Improved Map of India*, coloured and mounted in sections on linen, 36 by 25 ins., folded in roy. 8vo. slip case".

SHORTREDE (SHORTREED), Robert.
Bo. Inf. b. Jedburgh, NB. 19–7–01. d. 26–11–68, Blackheath.

Ens. 4–1–23 ... Lt.-Col. 12–10–57; ret. as Hon. M Gen. 31–12–61.

4th son of Robert Shortreed, sheriff substitute, of co. Roxburgh; bro-in-law to John S. Memes, LLD., of Manse of Hamilton.

m., Allahābād, 19–1–44, Clara Ann, dau. of Geo. Channer; possibly father of Robt. Shortrede, a Senior Examiner of Audit Dept. IO., 1889, who painted two water-colours now at IO. (*Foster* p. 95).

ed. Jedburgh gr. sch., and Edinburgh High sch.

Spells his name more often "Shortrede" and signing as such in 1857, as shown below. "Shortreed" is the form usual on Scottish border.

Had very stormy career as survr., falling out repeatedly with both Everest and Waugh—joined Deccan Svy. 1824—started Trig. Svy. of Bombay, 1828—posted to GTS., 1832—diverted to rev. svy. Bombay, 1835—resd. GTS. 1836—resumed Trig. Svy. Bombay 1838, promising obedience to Everest—permanent appt. to GTS. sanctioned 1840—resd. from GTS. 1845—joined Rev. Svy. Punjab, 1851, remaining till retirement.

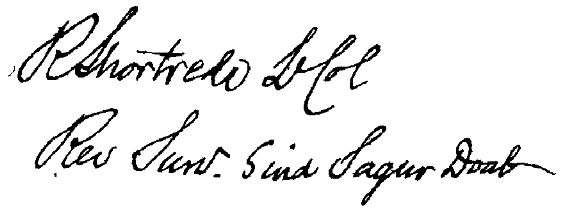
Logarithm Tables 1844; *ob.* notice, *RAS.* (*mn*) XXIX, 1869 (120–1).

Intended for civ. engr., worked in office of Robt. Stevenson, then Engr. of N. Lighthouses; Dec. 1822, visited OS. office at Tower of London [I, 316], Stevenson writing, 22–12–22, to Col. Colby [446 n.5] "The bearer, Mr. Robert Shortrede, was for some time in my office, and now goes to India under the auspices of Sir Walter Scott [auth.]. He is a very keen mathematician, and...[desires] an opportunity of seeing the extent of the Trigl. Survey in the Drawing Room"[2].

Being too old for Addiscombe and Engrs., accepted Inf. comn. with EIC.

BO GO. 1–3–24, appd. asst. survr., Deccan Svy.; recdd., 12–9–24, to draw staff allce. from 20–5–24, being "qualified to discharge all the duties of a Surveyor"; BO GO. 14–10–25, promoted to 1st cl. Asst.; 1827, special duty in Bombay [126].

15–3–28, with sanction of Supreme Govt., and approval of Hodgson as SG., appd. to conduct "a Trigonometrical Survey of the whole of the Bombay Presidency" [6, 209]. Measd. baseline at Karli, between Bombay and Poona, and for next 3 years carried triangles through Poona, Ahmednagar and Nasik [130–1, 210, 216, 344, 396, 454].



SIM, Duncan. Mad. Engrs.
bapt. 3–12–1791. d. 20–12–65.

Ens. 7–7–10 ... Col. 9–11–46 ... Lt. Gen. 6–2–61.

Son of James Sim, brewer of Aberdeen.

m., 12–4–20, Catharine, dau. of Abraham Couperus, a Dutch Govr., and wid. of Capt. Macleod, of HM. service.

ed. Addiscombe. *Oriental Club.*

1811, Java expn., svys. at capture of Cornelis, where he was wounded, 24–8–11 [339].

MMC. 29–9–12, "Ensign Sym, of the Corps of Engineers, to do duty under Lieutenant Caldwell as special surveyor of the defences of Vellore, Rayacottah, Bangalore, and Seringapatam. ... Will receive the same allowances as...drawn by... officers of the Military Institution when on survey" [II, 331].

1815, recdd. by Mackenzie for the permanent est. of survrs.; "I have proposed you for the Circar Survey [94, 100, 339–40]. ... I will have probably soon to direct you to...Karical, in order to run a line merely round the boundary, ... for we have got a plan of it from the Tanjore survey [II, 146]; ... it will be only a verification of that survey, & be rather a pleasant jaunt to you than a survey"[3] [475].

From 6–4–16 on svy. of Pondicherry, under the British Comnrs., 1816–9, for the restoration of Pondicherry and Karical to the French [98, 339]. He went on to make similar svy. for the restoration of Pulicat to the Dutch, and Mountford reports, 30–11–19;

"Lieutenant Sim, hitherto employed on political surveys, having lately been appointed to the Tank Department, the expence of his salary ceases with the present return[4]. His work at Pulicat has been completed, and the plan of the villages belonging to His Netherland's Majesty has been delivered to the Commissioner"[5].

1820. appd. Inspector General of Civ. Estimates [277]; later, CE., Madras.

[1] Statement of Services; 2–12–22; BTC. 22–5–23 (56). [2] Close (72). [3] DDn. 156 (41), 13–5–16. [4] Quarterly statement of expence from SG. [302, 324]. [5] DDn. 148 (211).

SIMMONDS, John Henry. Ben. Inf.
bapt. 6–1–1791. d. 7–5–69.

Ens. 6–11–08 ... Maj. 3–10–42; inv. 2–5–45; ret. 12–10–46; Hon. Lt Col. 28–11–54.

Son of John and Catharine Simmonds, of co. Kildare.

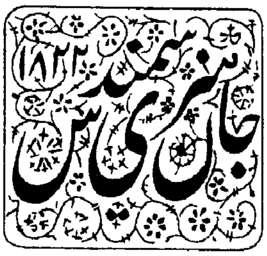
m., Calcutta, 15–2–38, Elizabeth Susannah, dau. of Sir Robt. Graham, Bart.

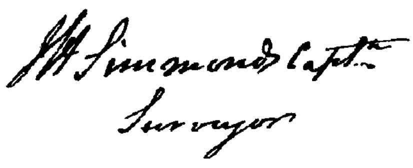
Hodson, IV (93).

1808–9, for 10 mo. at cadet coll. Bārāsat; 1818–9, with 3rd. Ceylon Volrs. in Bengal.

BGO. 29–1–31, to be Asst. Rev. Survr., Delhi, to date from 5–12–23[1] [156, 333, 394–5]; BTC. 29–11–27, appd. Survr. "to the Commissioner in the Sunderbunds", but obtained suspension of the order on the grounds "of the ill-health I have invariably experienced in Bengal". 1–10–29 took ch. of Delhi svy. from Oliver, and moved the party to Azamgarh at the end of 1833.

A gold seal used by Simmonds, bearing his name in Persian with date 1822, is preserved in the Fitzwilliam Museum at Cambridge. By permission of the Syndics of the Museum an enlarged imprint of this is given below, together with reduction from his English autograph[2].





SINNOCK, Henry. Ben. Inf.
bapt. 10–5–1785. d. 28–11–62.

Ens. 9–11–01 ... Maj. 13–5–25; ret. 13–7–27; Hon. Lt Col. 28–11–54.

Son of John and Mary Sinnock.

Hodson, IV (102).

1807–24, with Rāmgarh Batt.; route shewn in MRIO. M 542 1815–6, attributed to Lt. "H. Schalch" pr. error for Sinnock.

SKELTON, John. Bo. Inf.
b. 7–3–03. d. Poona, 8–4–26.

Ens. 17–1–24.

Son of Joseph Skelton, ch. clerk, Messrs. Cox, Greenwood & Co.; possibly nephew of Lt Gen. John Skelton, BO NI.

BO GO. 18–12–24, appd. Asst. 2nd cl. on Deccan Svy., having "been employed for 3 years on the Grand Trigonometrical Survey of England"[3].

SLIGHT, Stephen. Bo. Engrs.
b. 7–2–1797. d. 19–8–34.

Ens. 1–7–17 ... Capt. 5–6–29.

Son of George Slight.

m., 1st, Harriet Ann Gifford, sole heir of Lt.-Col. F. W. Gifford, pr. her bro.; she d., 20–5–21, "at Poonah of that malignant and fatal complaint, the cholera morbus, ...in her 19th year"[4].

m., 2nd, Edinburgh, 23–4–30, Charlotte Knox, dau. of Young Trotter, of Cruicksfield, co. Berwick.

1818, on Deccan Svy. under Sutherland [125]; BO GO. 18–7–20, appd. asst. to Ex. Engr. in the Deccan, to be stationed in Khāndesh; then Ex. Engr. at Baroda; BO GO. 28–8–20, to return to svy. duty under Sutherland; ib., 23–12–20, to act as Ex. Engr. s. Konkan.

BO MC. (camp), 31–1–22; to orders of PA. in Kāthiāwār for "survey of the south side of the Peninsula". BO GO. 17–9–25, relieved from svy. for fd. service under C-in-C. [127–8, 344, 352].

SMEE, Walter Nugent Thomas. Bo. Inf.
b. Calicut, 25–10–01. d. 7–2–77.

Lieut. 4–5–20 ... Gen. 26–11–75.

Son of John Smee, BO CS.

m., Malegaon, Nasik Dist., 3–9–38, Sarah, dau. of Wm. Hughes, of Hampstead Heath.

1825, appd. to Deccan Svy.

SMELT, Arthur. Ben. Inf. & BCS.
b. 8–6–1789. d. Calcutta, 26–11–49.

Ens. 13–8–05; resd. 23–7–07; appd. writer with antedate to 29–7–05.

Son of Rev. William Smelt, rector of Gedling, Notts.; nephew of Phillip Stanhope, 5th Earl of Chesterfield (*DNB.*).

m., 21–7–11, Francis Georgina, wid. of Capt. J. R. Mockler, Ben. Cav.

Hodson, IV (16).

1815–6, on rev. svy. Jessore Dist.; "Mr. Smelt...received orders...on 18th April 1815 to measure the lands in Mr. Henckell's[5] taluks (Jessore)...with the aid of amins, ... besides...all other lands...reclaimed from the forest". The large outturn of a sq. m. a day completed between Dec. 1815 and April 1816 does not point to a very high order of accuracy[6] [143].

BMC. 12–12–15 (150), allowed escort of a naik and 4 sepoys whilst "measuring the Sunderbuns Talooks under Territorial Department".

1822, Magte. and Collr., Murshidābād; from 1839, Sessions Judge, Patna.

SMITH, Charles. Ben. Inf.
b. 26–5–1786. d. Bareilly, 16–12–21.

Lieut. 1–2–07 ... Bt Capt. 1–1–19.

Son of John Smith, and Mary his wife, who m., 2nd.,—Culliford.

m., Calcutta, Miss Lauretta Françoise L'Elant.

Hodson, IV (117–8).

BMC. 27–1–16 (114), survd. Dacca cant. [14].

SMITH, Robert [II, 442]. Ben. Engrs.
bapt. 13–9–1787, Nancy, France. d. 16–9–73.

Ens. 29–4–05 ... Lt Col. 25–6–30; ret. 10–7–32; Hon Col. 28–11–54.

Son of James and Mary Smith, of Bideford, Devon.

CB., 1831. Hodson, IV (133–4).

1813–4, on svy. Mirzāpur s. frontier [II, 47].

BRC. 31–12–22, appd., to complete svy. of *doāb* canal under Tickell [24, 433]; allce. Rs. 500 in addition to mil. pay and allces.; B to CD. (Rev), 16–8–27 (405), Supdt. of *doāb* canal; ib. (414), on repair of Qutb Minār and other works at Delhi.

[1] Fdbk.1825–6; MRIO. M 517. [2] Gold pendant seal, engraved in intaglio on stone of lapis lazuli; from the Frank Smart colln., given to the Museum by T. J. G. Duncannon in 1930. [3] Bo MC. (camp) 1824 (129). [4] *As J.* 1821, XII (515). [5] Tilman Henckell (1751–92); BCS. 1769; Collr. Jessore, 1786–9 [I, 159 n.5]. [6] Pargiter (8).

SNELL, Charles. Mad. Inf.
b. 6-5-1791. d. 3-6-41. at Mundium, nr. Seringapatam. MI. French Rocks.

Ens. 27-8-07 ... Maj. 5-1-39.
Son of Robert Snell, sail-maker of Falmouth.
m., Falmouth, 7-1-37, Anne Alicia, dau. of Francis Todd, of Portman Sq.; their g. sons included the 1st Viscount Maugham and his yr. bro. Wm. Somerset the novelist (b. 15-1-74)[1]. Chas. Snell, junr., who joined Ganjam Svy. Dec. 1832, and d. on svy. in Ganjam, March 1857, was pr. a nat. son.
Oriental Club.
Dec. 1808. MMI. cl. IV [II, 320]; MGO. 18-2-09, owing to irregular conduct, to rejoin corps [II, 314]; July 1814, MMI. cl. VIII [II, 321]; MPC. 12-1-16, on fd. svy. with MMI. Jan. to May 1815.
MMC. 9-9-17, to Europe on mc.; "Has been labouring for a considerable time past under a severe affection of the lungs, which has reduced him to a state of extreme debility, attended with other symptoms of a dangerous tendency"; MGO. 13-8-20, returned to duty.
3-11-20, appd. to supd. svy. of Rājahmundry Dist., holding ch. in N. Circārs till 1833 [5, 101, 190-1, 320, 341, 350-1]; 7-12-25, granted med. leave to Cape but, no passage being available, took 6 mo. in Nīlgiri Hills. Montgomerie reports from Madras, 15-9-26, that he had "had a return of the complaints which occasioned his proceeding to the Neelgherry Hills. He arrived here yesterday in a very debilitated state, and will be under the necessity of proceeding to sea for...his health". Sailed from Madras to Calcutta, 30-9-26 [102, 321, 376].
DDn. 222, 19-1-27, resumed ch. of svy. at Vizagapatam 5-1-27 [103-4, 208].
Early in 1833 moved party from Ganjam to Nellore; June 1835, resd. from svy., and took furl. to England.

STEEL(E), Scudamore Winde. Mad. Inf.
b. 8-2-1789. d. 11-3-65.

Ens. 17-7-05 ... Lt. Gen. 2-9-61.
Son of David and Penelope Steel.
m., Madras, 19-5-40, Elizabeth Margaret, dau. of Lt.-Col. Wm. Read, DQMG. King's Troops.
CB. 1838; KCB. 1853. *DNB.*
July 1815, MMI. cl., IX [II, 321]; 1817, actg. Fd. AQMG., with Hyderābād Subsy Force; with Doveton in Berār [83-4]; April 1818, survd. routes between Aurangābād, Nasik, Chandur.
20-10-20, appd. asst. on Deccan Svy., for svy. S. Marātha country [125 ns. 6, 12, 208, 212].
MGO. 6-2-24, to be asst. in QMG.'s Dept.; ib. 2-4-24, as AQMG. with force from Madras to Burma; said to be the only officer able to take astr. obsns. [72].
1835, Sec. to Mil. Dept. Madras; 1845, MAG.; 1852-3, comdg. Madras div. 2nd Burmese War.

STEWART, Alexander [II, 443]. Mad. Inf.
b. 17-8-1788. d. Nāgpur, 4-5-24.

Lieut. 17-7-05; Capt. 1-9-18.
Son of James and Margaret Stewart, of Dublin.
m., Cape of Good Hope, 17-4-19, Johanna Anna Eksteen; a dau. was b., 2-1-21, at Nāgpur.
1806-8, MMI., cl. I [II, 320]; 1808-10, on Travancore Svy. [II, 131-2; III, 106]; 1811-3, on Java expn. [II, 320].
1816-8; AQMG. with Hyderābād Subsy. Force; 1816, survd. hills W. of Wardha R. [83]; at battle of Mehidpur, 22-12-17; mentioned in Malcolm's despatches; BO MC. 2-9-18 & MMC. 6-10-18, granted 6 mo. leave on mc. to Cape; after extension, returned to duty 20-10-20, and appd. AQMG. to Nāgpur Subsy. Force.
1822-4, held ch. of svy. of Nāgpur Territories till death [91, 93, 259, 469]. "His desire to connect the triangles deduced from the Takulkera base with ...points established by the late Colonel Lambton... south of the Godavery induced him to attempt the continuance of his observations through a most unhealthy jungle, ... and a fever contracted in those jungles almost immediately deprived the survey of its able...superintendent"[2] [491].

STEWART, Charles Alexander. Bo. Inf.
b. 12-2-03. d. 22-7-76.

Ens. 25-2-22 ... Maj. 11-11-51; ret. 14-11-54; Bt. Lt Col. 28-11-54.
Son of Duncan Stewart, Chamberlain of Kintyre.
m., Latenbury Hill, Hunts., 14-12-30, Charlotte Jane, dau. of John Macnab of Newton, co. Perth.
BO GO. 13-4-26, to be asst. to Survr. in S. Konkan; 1-inch svy. of "Veshree and Bankoth, Soowwurndroog Talooka, 1827".

STRAHAN, William. Mad. Inf.
b. 27-1-1789. d. 4-9-49.

Ens. 19-10-08 ... Col. 15-9-45.
Son of Alexander Strahan, of Aberdeen.
m., Calcutta, 12-2-24, Maria, dau. of Sir Herbert Compton, CJ. Bombay.
July 1812, MMI., cl. VI [II, 321], MGO. 18-11-14, appd. asst. in QMG.'s Dept., svy. branch, 2nd cl.; 1816; on svy. of Ghāts, from Ajanta, and of routes in Berār [83 n.6]. MGO. 24-6-17, to be fd. AQMG. with Hyderābād Subsy. Force.

STRETTELL, Edward Francis. Ben. Inf.
b. Calcutta, April 1791. d. Saugor, 3-9-19.

Ens. 14-7-07; Lieut. 10-7-12.
Son of Edward Strettell, Adv. Gen., Bengal.
Hodson, IV (202).
MRIO. M 332, route svys. embodied in Franklin's map of Bundelkhand [449]; DAQMG. 1-1-17 [335].

SUTHERLAND, James [II, 443-4]. Bo. Inf.
b. 1780/2[3]. d. 15-5-50.

Lieut. 30-1-1798 ... Col. 5-6-29; M Gen. 1838.
pr. son of Capt. Wm. Sutherland—Ens. Bo. Inf. 1775—HM. 53rd Ft., 1777—and Capt. 55th Ft. 1782; bro. to Milford Sutherland "of H.M.'s military service", and nephew to James Sutherland, Master Attdt., Bombay, 1802-5; cous. to James Cruikshank [435].
m., Bombay, 20-1-14, Maria, dau. of J. H. Cherry, BO CS.
KLS. 1810 [II, 443 n.12].
Oriental Club.
From 1802, asst. to SG. Bombay [II, 305, 323]. 1808-12, Survr. with Harford Jones' mission to Persia [II, 176, 339]; BO GO. 31-1-14, on return to India resumed appt. under SG. till abolition, being then emp. on rev. svy. of Broach [169].

[1] *Gen Mag.* 11/6, June 1952 (20). [2] from Norris, 14-4-28, DDn. 231 (134); *IO Cat.* (26), angles obsd. by Capt. Stewart from Lambton's base at Ellichpur. [3] swears, 19-4-1797, that he was then aged 15 to 17.

April 1818, on svy. of passes in Khāndesh and Deccan "from Songur[1] to Boorhanpoor, between the River Taptee and Satpura Mountains" [83, 122, 351]. BO SC. 30-7-17, on svy. of "Eastern Borders of Guzerat, to the Northward of the Nerbudda", with Geo. Jervis as asst. [II, 409].

Foster (8-9) records painting at IO. of "The Battle of Kirkee; The British troops under Colonel Burr [432]; ... from a drawing by Major Sutherland".

DDn. 144 (114) 6-12-18, to ch. of svy. of Peishwa's country under Elphinstone, Resdt. at Poona [5, 123-5, 344], who writes; "You are in possession of such fragments of the survey formerly made under your management as have been saved from the Residency" [125 n.4].

Held ch. of Deccan Svy., with hdqrs. at Poona, till appd ASG. Bombay, 1-5-22 [209-10, 212, 233, 280, 464]; upgraded to DSG. from 12-5-23, hdqrs. remaining Poona [6, 126, 281, 292, 320, 323, 351, 440].

BO GO. 10-2-26, granted furl. for 3 years from date of embarkation, the GOC. recording that "During nearly the whole period which Lieutenant Colonel Sutherland has been in India he has been employed in the survey department, having been appointed 2nd assistant to the Surveyor General in January 1802, and has not done any regimental duty since that time. His merits and services in that branch... are best known to Government"[2].

Before sailing he asked that his salary as DSG., should be raised, from date of appt., to that formerly allowed to the SG. Bombay, pointing out "my length of servitude in the Survey Department. ... In the year 1809, I was appointed Surveyor with His Majesty's Mission to the Court of Persia, and was employed...in exploring some of the most unfrequented parts of the Persian Dominions. The principal materials of the survey...were unfortunately lost in His Majesty's Ship Pomone while accompanying Sir Harford Jones to England [II, 444] but, although thus deprived of the means of bringing the result of my labors to the...notice of Government, I...refer them to...Sir Gore Ouseley. ...

"On my return to India in 1813, I rejoined the Department...and was employed on the revenue survey of Guzerat till...1816, when I was nominated to the Deccan"[3].

IO. Misc. 66 (1133), CD. write to Sutherland, 18-5-27, addressed 19 Montague St., Portman Sq., declining to grant him the higher salary asked for.

SWANSON, John. Bo. Inf.

b. 2-3-01. d. 8-4-66.

Lieut. 11-6-21 ... Col. 20-6-57; ret. as M Gen. 31-12-61.

Son of Francis Swanson, of Dumfries Militia,

m., Dapoli, near Bānkot, 16-2-29, Maria, dau. of M Gen. E. A. Willis, Bo. Est.

BO GO. 19-8-22, to Deccan Svy.; BO MC 5-12-22, "fully qualified to discharge the duties of a Surveyor", to draw svy. allces. from 7-11-22; BO GO. 21-10-23, relieved from svy. duties, being appd. adjt. 2/10th NI [125 n.12], and later emp. as pymr.

Dr. Kennedy met him, July 1839, with Army of the Indus; "The party in which I rode was much amused at the military metamorphosis...of a quiet, sober-minded, staff officer of the civil department into a fiery cavalier. Capt. Swanson, Military Paymaster of the Bombay division, belonged to the 19th regt. BO. N.I. and, as...a...gentle passage of arms had been promised for the morning's amusement, he had as a matter of duty joined his regiment.

"We, who had been wont to know him as a member of the staff mess, one of the mildest of men, & most obliging of paymasters, were amazed to see his tall, handsome, and manly figure, mounted on his large grey, which on ordinary occasions never looked half so big, or half so fiery, coming galloping up with "Move out of the way, gentlemen, if you please", and instantly taking up a point for his regiment, which had to form and halt where we had dismounted.

"My inward wonderment was whether any change of circumstances could possibly have made me go over such ground at such a fashion, for, in our every-day temperament, my excellent...friend was fully as...averse to any ultra-rapidity of locomotion as myself"[4].

SYME, Nicholas. Mad. Inf.

bapt. 9-11-1792. d. 6-7-19, Mandleshwar, on Narbada, 40 m. s. of Indore.

Ens. 4-12-09; Lieut. 23-3-16.

Nephew of John Syme.

MRIO. 161 (8), plan of about 100 m. of Narbada R.; DDn. 145 (571), 19-11-19, allowed Rs. 250 pm. for period of svy. [84-5].

TANNER, Henry. Ben. Inf.

b. 17-1-1781. d. Monghyr, 29-5-54.

Ens. 12-10-1797 ... Capt. 8-6-06; inv. 18-2-15.

Son of William Tanner, of Berwick.

m., Calcutta, 10-10-1800, Miss Catharine Driver.

Hodson, IV (234-5).

BTC. 30-1-24 (13), as survr. under Bd. of Rev. Patna, submits from Monghyr svy. of certain *mouzas* in Tirhut; BGO. 21-10-25, to officiate as Regulating Officer to Bhāgalpur Invalid Thāna; survg. limits of inv. lands.

Invalid lands were "inhabited by invalid pensioners of the E.I.C.'s regiments, who, when disabled in the service, have the option of retiring to one of the many villages set apart for that purpose, where a spot of ground is allotted to each individual, and a few rupees paid monthly to them by the Superintendent, or visiting officer. This gratuity affords the seapoys an opportunity of sitting down comfortably with their families for the remainder of their days"[5].

From 1825, on svy. of Dāman-i-koh Govt. Estate, Santāl Parganas, and other areas of Bhāgalpur and Monghyr, till Feb. 1833, when he submitted mc. from Monghyr to effect that it was "impossible for him to leave the station, or to undertake the execution of duties of any description without imminent risk of the most serious consequences" [137, 333].

JRGS. II, 1832 (317), reports from Bhāgalpur, 4-3-31, on coal seams worked on banks of Ganges.

Efforts were made in 1835 to obtain his services for svy. of pargana Pharkaya; "The abilities of Captain Tanner as a Revenue Surveyor are not unknown. ... A residence in the district of 20 years, during 14 of which he had been employed in this very duty, qualify him in no ordinary manner. ... His local knowledge of this part of the country is probably more extensive than that of any of its inhabitants, combining as it does scientific attainments with practical experience"[6]. He refused further svy. empt.

Was occasional contributor to ASB., sending in 1835 a "Note on fossil bones of the Rajmahal Hills"[7].

TATE, Robert. Mar. Survr.

Asst. Survr. & Dmn. 1-9-18; disch. 31-12-21.

Sept. 1809 to Jan. 1810, in drawing-office of Mar. Survr. at Calcutta [II, 296].

[1] Songir, 100 m. w. of Burhānpur. [2] Bo MC. 4-2-26. [3] ib. 22-2-26. [4] Kennedy, II (26-7). [5] Anne Deane (40-1). [6] from Comnr. of Rev., Bhāgalpur, 18-4-35; BRC. 6-10-35 (20). [7] *JASB*. IV 1835 (707-8).

1811-2, Master's mate in HEIC.'s *Malabar* with expn. to Java. From Feb. 1812, actg. Lieut. in HEIC.'s *Nearchus*, under Charles Court, Mar. Survr.; resd. and sailed for England to take up private business.

Aug. 1818, in Calcutta; recdd. by SG. to asst. Webb on svy. of Kumaun; appd. from 1-9-18 on Rs. 200 pm.[347].

"My services in the surveying department commenced under Captain Wales, Marine Surveyor General [II, 448] when a volunteer in the Marine, with whom I remained till his death [15-1-10]. ...

"Till the arrival of a successor to Captain Wales, I accompanied the expedition against the Island of Java as a Master's Mate of the Honorable Company's cruiser Malabar, and also held the appointment of Assistant to the Agent of Transports, and Secretary to Commodore Hayes [70 n.5]. ...

"On the arrival of Captain Court as Marine Surveyor General [II, 296], I...was directed to rejoin, ... and continued to serve with him as an Acting Lieutenant on board the Nearchus till, at the suggestion of my relations, I applied for permission to resign, ... with the intention of entering into mercantile business, where a prospect of success then offered.

"During my voyage to England, however, the Trade in India was thrown open, and the state of my prospects became so much altered on my return to India, that after a short period I determined...to regain some employment in the service of Government. To return to the Marine Surveying Department with rank was of course not in my power; I therefore applied to Colonel Mackenzie...and, at Captain Court's recommendation, Colonel Mackenzie obtained me the appointment of Assistant Surveyor in the Kumaon Survey"[1] [329 n.2].

Travelling up the Ganges by boat from Calcutta, Tate reached Patna 17th Nov., and Ghāzipur 25th, where he halted nearly 3 weeks. Reaching Benares 19th Dec., he travelled overland to Lucknow, and joined Webb in Jan. 1819 [48].

Webb did not find him a great success; "Tate is not a diligent man in business. His disposition is by no means indolent, but he prefers other employment before those to which I would fain direct his whole attention. ... He would willingly give up a week to mend a tent, or make a box, or darn his stockings, which might be occupied more advantageously for the survey otherwise. ...

"When he joined last year I recommended such tents as I thought would best suit him, and got a friend...to make them up for him at Futteguṛh. They were finished in a week or ten days, and we received them before we returned to the hills. These may require some repair, and I arranged his work so as to carry him to Bareilly, and...to halt ten days, ... in which time a new sett of tents might if necessary be prepared". From Bareilly Tate asked for 2 mo. leave to buy tents and camp equipment, on which Webb commented that "camp equipage for the Governor-General might be got ready in two months, instead of a hill tent not much larger than a necessary [II, 395 n.1]. ... If, however, you should be inclined to give him this leave, ... his absence will not be very injurious...to the survey" [367, 512][2].

Having no other asstce., Webb found work for him as dmn., till the svy. was completed, but he was an uncongenial companion. He was disch. from 31-12-21; and was much disappointed at being offered no further work [367-8].

TATE, William Ashmead [II, 445]. Bo. Engrs.
b. Bombay, 3-11-1795. d. 21-11-71.

Ens. 12-7-12 ... Capt. 17-9-24; ret. 5-12-29.

Son of James Tate and Sarah Pruen, pr. dau. of Ashmead Pruen, Bo. Mar., and sister to Mrs. Billamore senr. [423].

m., 1st. Bombay, 12-12-20, Elizabeth Saunders, dau. of W. T. Edwards, HM. 17th Foot.

m., 2nd, Clifton, 17-9-44, Miss Isabella Prideaux.

From 1816, on rev. svy. of Bombay and Salsette; BO GO. 7-5-21, appd. to ch. svy. [167-8, 343, 439]. Aug. 1827, on close of svy. sailed for England 5-8-27, after submitting final report, Salsette, 4-8-27;

"Having now brought to a close a survey in which I have been for so many years almost unremittingly engaged, ... I have...been enabled to collect much interesting data connected with the general history, topography, as well as the resources of the Island, ... yet, from a want of time, ... and also from the late impaired state of my health rendering a voyage to Europe necessary, I shall most reluctantly be obliged to submit a very hasty and incomplete report"[3].

In his address to the Brit. Assn., 26-8-38, Thomas Jervis quotes letter from Tate, written from East Harptree, describing valuable work done by Indian survrs. and dmn. on the Bombay svy. [168, 392-3].

1849-59, Professor of Mil. Drawing at Addiscombe, being a beautiful dmn. himself.

TAYLOR, Joseph. Ben. Engrs.
bapt. 27-1-1790. d. Agra, 20-4-35, of apoplexy; MI.

Ens. 6-10-07 ... Lt.-Col. 18-6-31.

Son of Joseph and Margaret Taylor.

m., 1st., Agra, 30-8-11, Anne, dau. of Rev. Jonathan Bourchier, of Epsom; she d., Agra, 11-7-14.

m., 2nd., Calcutta, 1-5-19, Frances Henrietta, 3rd. dau. of Robt. Colebrooke, SG. Bengal 1794-1808 [II, 386-91], whose portrait [II, 391; pl. 19] was in 1949 in possession of Mrs. Taylor, g. mother of Robt. Hyde Colebrooke Taylor gt.-g.-son of Joseph Taylor [II, 386, n.6].

Hodson, IV (240-1)[4].

1810-11, asst. to Garr. Engr. at Agra. DDn. 126 (4), recdd. without result by SG., 24-3-10; if he "can be spared from the duties...of Agra, ... [he may be posted] as assistant under either Lieutenant Webb or Lieutenant White, that he may gain an accurate knowlege of this part of his duty". Repaired Tāj, and Akbar's tomb at Sikandra.

Jan. 1820, to construct lighthouse on Sāgar I. [II, 15]; 18-10-21, appd. Garr. Engr. & Ex Offr., Agra, making svy. of Agra, scale 1,000 ft. to 3 inches[5].

TAYLOR, Thomas Matthew. Ben. Cav.
b. 12-5-1791. d. 2-9-71.

Corn. 27-3-09 ... Gen. 8-2-70.

Son of James Taylor, of Clogher, Ireland.

Hodson, IV (243).

1823, appd. asst. to Schalch, Supt. of Canals, Calcutta, on "salary of 500 rupees per mensem in addition to his military pay and allowances"[6]; on svy. and maps of waterways s. of Calcutta [14][7].

BTC. 17-9-24, to mil. service with Pioneers and Survrs. under Schalch, but took leave to England on mc.; "I have a violent attack of illness incurred by fatigue, & exposure to the effects of the sun, in completing the surveys & levels for the Agur Canal during the months of April & May 1824. ... I was subsequently obliged to go to sea. My health has been in such a precarious state that...I considered it necessary to consult...Presidency Surgeon"[8] [333].

1833-5, MS. to GG.; 1837-40, member of Svy. Com. in addition to other duties.

[1] DDn. 195 (65-9), 25-3-22. [2] DDn. 150 (131), Jan. 1820. [3] Bo RC. 28/1827 (41). [4] Pankridge (53) wrongly gives domestic details from career of another Taylor. [5] *Ben Regr.* 244 (28). [6] B to CD. (Rev.), 30-7-23 (250). [7] MRIO. 166 (11, 12); *Ben Regr.* 35 (99-105). [8] DDn. 213 (37), 17-8-25.

TAYLOR, Rev. William Munro. Missionary. b. 1797/8. d., Madras, 22-8-78.

Ord., Liverpool, 13-8-23, as Minister of "free" church; ord. Madras, 8-1-37, as Deacon, C. of E.; priest, 1839.

JASB. V, 1835 (512-3); VIII, 1838 (105-31, 173-92, 372-414, 469-521) *Hindu Mythology* (pref); *Mad J L & S.* vols. 8-11, 13, 15-6; *J (R) As Soc.* (London) II, 1879 (xvii-xviii); Penny, III (362, 393); LMS. and SPG. Records; Mackenzie.

Not a Surveyor.

Penny (362), "born and bred in Madras"; ed. LMS. School, Gosport, England.

CD to M. (Pub), 29-10-23 (11), permitted to proceed to Madras as missionary of LMS.; arrd. Madras 22-5-24; held ch. in Pursewakum till resd. LMS. service 14-11-34, having become a notable Tamil scholar.

1835, as Rev. Wm. Taylor, recdd. by ASB. to catalogue Mackenzie Mad. colns. on behalf Mad. Govt. and Mad. Lit. Soc., *v.* MPC. 18-10-36 (23-4); 18-4-37 (81-2), and 9-6-37 (14-5). His reports made Oct.-Dec. 1837, pub. in Mad. and Calcutta [482].

Further pubns. on oriental mss. included a *Catalogue Raisonnée* 1857-62, and *Handbook of Hindu Mythology*, 1865; 2nd edn. 1870. Under pseudonym "Munro", wrote *Madras-iana.* pub. 1889. "Munro" is also given as his 2nd name in record of death, Mad. Eccl. 59/297 [482 n.6].

After his ordination in Madras, the Bishop writes to SPG., 10-1-37, describing him as "brought up in this country", and "one of the best Tamil scholars in the country". He was appd. to SPG. on Rs. 125 pm.; held ch. of Vepery mission 1841-5, compiling history of the mission 1726-1826.

1853, at St. George's Cath.; 1854-67, chpn. at Vellapuram, nr. St Thomas' Mount; 1878 at Bangalore.

TERRANNEAU, Robert. Rev. Survr., uncov. b. Calcutta 24-12-1790. d. 19-11-41, Morādābād.

Asst. Rev. Survr., March 1827.

Eldest son of William Terranneau, son of Charles Cossard de Terranneau [I, 388], indigo planter of Rangpur, Bengal, and his wife Elizabeth, dau. of Capt. Mitchell., Mad. Est.; Wm., his father, was b. in Bengal, ed. in London; returned to India as an officer of HM. 42nd Ft.; resd., took up business in Calcutta, and then took to indigo and d., Rangpur, 19-4-50, aged 87. Of his 5 children, Robt. applied for cadetship without success—Wm. Henry (1791-43) and Charles (1808-35) were both in Ben. Inf. (Hodson, IV)[1].

Robert m., Bareilly, 5-8-27, Elizabeth Addison Browne.

Being in Calcutta in 1814, left for Java, March 1816, in ship *Union.*

13-4-26, appd. Registrar, Morādābād Dist.; "On the 2nd of April, whilst at Begnire" had applied for appt. to rev. svy. but "as the Registrarship of this district was vacant, I did not hesitate (with the view of rescuing myself from the humiliation of eating the bread of dependence, having been then 5 years the sport of fortune & destitute of a situation) to accept the situation of Registrar temporarily, until I could procure...the one I had applied for. ... I was ready at the moment to give up the Registrarship"[2].

On recdn. of the Magte., Halhed [154-5], and the SG.,[3] appd. Asst Rev. Survr., pr. from 8-3-27, and posted to rev. svy. of N. Div. of Morādābād; continued on rev. svys. of Upper Provs. for several years [155, 334, 370].

TETLEY, James. Civ. Survr., uncov.

Nat. son of Col. James Tetley, Ben. Inf., who d., Allahābād, unm., 11-11-20, and bro. of Chas., dmn. in SGO. 1800-5.

1815-6, made svy. of Dacca city, on salary Rs. 200 pm., with allces. for est. and contt. expences[4] [14].

THOMSON, George. Ben. Engrs. b. 19-9-1799. d. 20-2-86.

Ens. 1-9-18 ... Maj. 23-7-39; ret. 25-1-41; Lt Col. 28-11-54.

Son of George Thomson, of Fairley.

m., Aberdeen, 4-2-30, Anna, dau. of Alex. Dingwall of Rannieston, and sister-in-law of John Anderson, Ben. Engrs.

CB.; *DNB.: DIB.:* Hodson, IV (265); Pankridge (54).

1824-5, Burmese War, Arakan, on svys.[5] in addition to other engr. duties [68-9, 181, 333]. *Govt Gaz.*, 14-4-25, describes services in Arakan; BGO. 10-4-25, to be Ex. Engr. to Div., and charged with building cants.; HMS. 666 (561), 27-5-25, report whilst in ch. pontoon train; Nov.-Dec. 1825, with Crommelin on svy. of islands off mouth of Arakan R. [435].

pr. about 1826-7, ran levels between Calcutta and Salt Lakes [13-4]; road svy. of Shāhābād, *Ben Regr.* 6 (26). MRIO. 63 (5), svy. of new road, Benares to Parasnāth, 1833-4; this was the section of Grand Trunk Road, of which Sandes writes; "The true beginning was made by Lord Wm. Bentinck, when George Thomson...—afterwards known as "Thomson of Ghazni" because of his exploits in the First Afghan War—was appointed. ... Thomson worked for five years on the Burdwan-Benares section before leaving civil employment to become Commandant of the Bengal Sappers & Miners at Delhi in March 1837"[6].

1839, CE. with Army of Indus, at Ghazni, Afghānistān; auth. of *The Storming of Ghazni.*

TRANT, Thomas Abercrombie. HM. 95th Ft. d. 13-3-82.

Possibly related to Wm. Henry Trant (1781-1859), from co. Cork, proprietor of EIC. stock, and to Thos. Trant, Mad. cadet of 1781, who met Wm. Hickey in Calcutta 1783-6.

BGO. 27-3-24, appd. to General Staff with expn. to Burma, being tr. from 95th to HM. 38th Ft.;[7] 11-2-25, appd. DAQMG. 1st. cl., with force in Burma.

DDn. 216 (36), Jackson, DQMG., writes to Grant, 25-8-25, "There is no fear of your being required to do common survey work, as I have a young officer, Lieutenant Trant, who does that kind of thing very well", and Grant himself writes later that "the industry of Lieut. Trant, and his experience as a practical surveyor, were eminently conspicuous, and to his exertions mainly are we indebted, under the directions of Major Jackson, for the principal surveys executed during the war"[8] [70-2, 462-3].

Henry Yule refers in 1853 to "a beautiful survey by Capt. Trant, in the Q.M.G.'s office", of the Irrawaddy below Prome[9].

Trant distinguished himself on several occasions, and the *Ben Harkaru* of 6-3-26 reports "his action against the Burmans" that led to "Sir Archibald Campbell's splendid victory at Pagham Mew[10] on 9th February; Lieut. Trant of the Surveying Department was in advance of the Army, on the look out...with 30 men of the Bodyguard, when he fell in with Mat Wyn Boo and 100 men. He attacked them without hesitation, killed two of their chiefs, and took 50 prisoners, and the remainder dispersed confusedly"[11].

[1] In N. Park St. cem. is MI. to Robt. B. Terranneau (1824-49) not identified; at Meerut, 15-11-26, James Alex. Cossard Terranneau m. Matilda Maria Delpeiron. [2] dated Morādābād, 8-2-27; BTC. 8-3-27 (80). [3] BTC. 24-8-26 (44). [4] MRIO. Misc. 2-0-03; BJC. 8-3-16 & BMC. 15-3-16 (158). [5] MRIO. 157 (49-53), svy. of creeks. [6] Sandes, II (56-7). [7] 95th involved in mutiny at Barrackpore, 1824, Cardew (145). [8] DDn. 240, M 420. [9] Note on MRIO. 157 (8). [10] Pagan Myo, on Irrawaddy, 20 m. below Pakokku. [11] cf. HMS. 668 (58).

March 1826, survd. route of a dett. of British troops over the An Pass, taking 12 days on the road[1] [3, 71–2, 494].

Auth. of *Two Years in Ava;* May 1824 to May 1826, "by an officer of the Q.M.G.'s Department", pub. 1827; also of *Narrative of a Journal through Greece in 1830*, pub. 1830.

Afterwards a Capt. in 1st. WI. Regt.

TREBECK, George. Traveller.
d. c. Nov. 1825, Mazār-i-Sharīf, Afghānistān.

With Moorcroft to Ladākh and Bukhāra, 1819–25 [43, 486–7].

Son of Charles Trebeck, senr., attorney of London and of Supreme Court, Calcutta and later of Penang, where he d. 1831. Will dated 30–6–31; property sold 9–11–31 included 37 neckcloths—31 pairs cotton short stockings—1 yellow Nankeen umbrella—24 bottles...beer—1 pr. crutches".

Bro. of Chas. Trebeck, junr., also attorney, Calcutta, from 14–1–23; pr. related to family of lawyers and clergy ed. at Westminster (*OW.* II, 926–7)[2].

Wilson records that "Mr. George Trebeck was a young man on the threshold of life. ... His father...had been a solicitor in London, and had settled in the same capacity in Calcutta. ... George, who had a turn for adventure, accompanied Mr. Moorcroft. ... To him the geographical details were intrusted. ... He was able to keep a regular field book, which he did until the party quitted the Punjab. The information he records is minute and accurate" [452].

Started svy. at Bilaspur, July 1820, carrying it to Leh, and later survd. other routes to all parts of Ladākh. 1822–3, extended svy. through Kashmir, Pūnch, Rāwalpindi, and Peshāwar to Kābul, where his insts. were stolen [43–4, 486].

On return march from Bukhāra in Aug. 1825, whilst Moorcroft visited Andkhui, Trebeck "moved to Mazar; after an interval he was siezed with fever, and died after four months suffering"[3].

Burnes writes that when he passed through Mazar 7 years later, "One of our companions, a Hajee, [had] attended him on his death-bed, and conducted us to the spot in which he is laid, which is in a small burying-ground eastward of the town, under a mulberry tree.

"This young man left a most favourable impression... throughout the country, ... and I could not but feel for his melancholy fate. After burying his two European fellow-travellers, he sank, at an early age, after four months suffering, in a far distant country, without a friend, without assistance, and without consolation".

Burnes notes that the local people had taken possession of all the property left, "horses, camp equipage, money, and...printed books". But many books and papers had already reached Moorcroft's friends in India [487], and when Dr. Lord visited Mazar-i-Sharif in 1838, he had no difficulty in recovering practically all the remainder. He found amongst "a pile of loose accounts" a note in Trebeck's writing; "Sept. 6th 1825. Arrived Balkh Aug. 25th; Mr M. died Aug. 27th".

On pubn. of Wilson's narrative, 12 copies were presented by the Directors to his bro. Chas. Trebeck, who was in London March 1841; *JASB.* X, 1841 (501–2)[4].

TRUMAN, Avery. Mad. Inf.
b. 13–12–1786. d. 2–6–31, Kottora, Nāgpur.

Ens. 15–12–08; Lieut. 4–10–13.

Son of Avery Truman, of Stowell, Glos.

July 1812, MMI. cl. VI [II, 321]; on fd. svy. Jan–May, 1814; 1816, on svy. of passes in Berār and Nāgpur Territories; d. in camp soon after svy. began [84].

TURNBULL, Thomas. Asst. Rev. Survr.
b. 1781. d. Madras, 2–6–31.

Appce. 3–6–1794.

From survg. sch. to survey—Devicottai, 1797–8 [I, 109 n.1, 114, 195, 284]—Dindigul, 1798–1804 [II, 140]—Tanjore, 1805–10 [II, 145–7]—Madura, 1811–4 [II, 140, 164].

1815–6, in ch. re-svy. of Dindigul [II, 140, 352, pl. 13; III, 110, 373, 400], moving to Travancore in Nov. to work under Ward [106–7, 109, 511–2], who writes; "I have found him to be a very useful and intelligent man. ... Now far advanced in life, ... eyesight ...very bad. This misfortune...does...disqualify him to follow the duties of a Surveyor; yet...I have that confidence in him. ... He could be in charge of a party of the young men, merely to see them do their duty. ...

"He would be of great assistance in making translations of any Histories we may...collect, from his knowledge of the languages, & in drawing up materials for the memoirs; but, as to expect him to survey is almost absurd, tho' he may be anxious & willing, yet the work he may perform must always remain as a matter of doubt as to its accuracy"[5] [109].

On close of the svy., Dec. 1820, was sent to Tinnevelly with interpreter Nital Naymal to prepare statistical account of that dist., his health and eyesight having for some time prevented him from plane-tabling [111 n.1, 167, 320–1].

1822, brought into Madras, and emp. on instrn. of appce. survrs., being still so emp. in 1830 [208, 374, 377]. His son Wm. Henry served the dept. from 1827 till his death in 1853 [386].

Van HEYTHUYSEN, Henry Thomas. Mad. Inf.
b. Kent, 27–2–1792. d. 18–5–82; MI., Southborough, Kent.

Ens. 25–5–11 ... Capt. 25–4–25. invd. 6–3–29; ret. 24–6–36.

Son of Gerard Levinge Van Heythuysen, clerk in Court of Chancery, and Amy, his 1st wife.

m., St. Pancras, 5–4–32, Marry Ann, dau. of John Sich of Chiswick.

1822–3, survd. route of his batt. from Orissa, through Chattisgarh, to Nāgpur, making wise comments on the country and people; met Roughsedge [II, 439–40]. Though fdbk. carefully kept, with very clear sketches [410], Montgomerie found "the descriptive part...tolerably good, but the protraction does not at all agree with the register of bearings, and none of the bearings differ from each other less than *four points of the compass.* Capt. Otto says that, as far as he remembers, Mr. Van Heythuysen *destroyed the whole of the Guides' Routes*"[6].

VOYSEY, Henry Westley. Asst. Surg. & Geologist. d. 19–4–24, nr. Sulkia Ghāt, Howrah.

Hospl. Asst. & Asst. Surg. HM. 59th Ft. 12–5–15—tr., without joining, to 46th Ft. 29–7–19 to 1st Ft. 30–3–21—half pay, 6–2–23.

[1] *As J.* Oct. 1826 (491); HMS. 669 (58); *JASB.* XI, 1842 (1135–57). [2] wrongly described as German by Holdich (439). [3] Moorcroft & Trebeck, I (xxv-vi). [4] *JASB.* VII, 1838 (665–6). [5] DDn. 156 (206), Anjengo, 28–3–17. [6] DDn. 202 (105), 14–4–25.

Appd., 8-5-18., Surg. & Geolgt. GTS.[1]; joined 15-12-18 [I, 228].

Memoir by H. H. Wilson, *Oriental Qy.* I, 1824; re-pub. *As J.* XVIII, 1824 (590 *et seq*); XIX, 1825 (262 *et seq*); *JASB.* X to XIII, *passim.*

"Educated for the medical profession...both in the schools of London and Edinburgh. On his joining the army he served some short time on the Continent in the campaign that was so gloriously terminated by the victory of Waterloo. He accompanied the troops to Paris. ...

"Early attention...to mineralogy and geology. He studied these sciences under Professor Jamieson and [accd.] ...the celebrated geologist Maculloch[2] in one of his visits to the west coast of Scotland and the Western Isles. ... A sound chemist. ...

"Accompanied his regiment to the Cape of Good Hope, where he was induced...to come to Bengal. ... Scientific and literary attainment...secured him friends in Calcutta. ... His belonging to a corps not in the country rendered it difficult...to employ his talents advantageously. ... After some time, however, he was attached to the survey under the late Colonel Lambton, as Surgeon and Mineralogist [225, 264–5, 352, 401–2, 466].

"Besides his professional and mineralogical acquirements, Mr. Voysey was well grounded in Natural History. It was during his stay in Calcutta that the French naturalists, Messrs. Diard and Du Vaucel, pupils of Baron Cuvier [272–3], arrived at the Presidency, and Mr. Voysey's knowledge of their language, as well as a similarity of tastes, united him with them in all their early researches. He had also a good knowledge of Botany, and...his attachment to the survey could not fail to yield an abundant harvest. ...

"Mr. Voysey joined the survey in the end of 1818" [325].

Other testimonies to his talents are left by a fellow student at the General Hospital at Aberdeen, who records that during his two years at the hospital and the Marischal Coll., Voysey had already shown a strong bias towards Natural History. Another friend had met him "at the Cape of Good Hope, whilst he resided in the family of Mr. T. Sheridan"[3].

He joined at Hyderābād 15-12-18, and a few weeks later accd. Lambton and Everest into the field [227–9, 231, 265, 442]. "By the middle of 1819 he was fully occupied, not only with geological collections and reports, and a map he had then commenced, but with the operations of the survey. ... He soon qualified himself to give effectual assistance...as a surveyor, and was...often sent out to take detached points and particular stations [232, 244, 249]".

The following is taken from his account of a 5 mo. tour during 1820; "I returned to Hyderabad in the middle of April with a very severe intermittent fever. As the moon approached the full I recovered, but had a relapse the next lunation. I was forced...to prepare specimens and a report of my Geological map...notwithstanding my fever and, as soon as I had finished and despatched it, I went out again to the banks of the river [Godāvari].

"I remained out until September, making considerable additions to the Geological map, ... and returned in the middle of the month. I had not been a week at home before a relapse of fever occurred, which enfeebled me completely; nevertheless, as a party was going out under a Sub-Assistant to those interesting mountains, the Nulla Malli, ...south of the Kistna, I...set out to join them [227].

"On the way, forgetting, in my wish to compare barometrical and trigonometrical heights, that I had been ill, I ascended an old hill station of Col. Lambton's...and, although I gained a very satisfactory result, I was again attacked by my complaint. As soon as I was able, I travelled towards Madras for the benefit of the sea air, but when I was only forty miles from the pagoda of Perwattam, I left my baggage, and determined at all risks to visit it. I was the third European who had ever been there. The Sanyasi who performed the service of the temple recollected Colonel Mackenzie"[4].

It was of this journey that Lambton wrote to De Penning, 13-11-20; "Doctor Voysey is now so ill of the fever that I have given him leave to go to Madras, and he will set off in a day or two. It was his intention to fall in with you, ... but I have advised him to get to the sea coast as soon as possible. ... As you seem to be pretty healthy in camp, his not joining you will not be of much consequence". And again, 26-12-20; "I have heard nothing of Dr. Voysey since...he arrived at Kurnool. He had had repeated attacks of the fever, and intended resting a few days, and writing to me when he got better, but I left it to his own judgement whether to do that, or to proceed to Madras"[5].

After Everest's departure to the Cape on mc., Lambton looked continually to Voysey for asstce., and after Everest's return sent him on an independent mission to report on the country to the north, travelling via Calcutta, and picking up the line of the Great Arc southwards from Agra. At the same time Lambton "endeavoured to obtain...his official appointment as assistant to the survey [265]".

"In prosecution of this claim...Mr. Voysey visited Calcutta in the end of 1822. He was also charged with...a preparatory journey thro' Mālwa and Goandwana, in order to lay down the line most elegible for the progress of the Trigonometrical Survey from Nagpur to Agra [236, 243–4, 414, 438, 467–8]".

Lambton was the more anxious to improve Voysey's financial position as his appt. to the svy. debarred his promotion in the British service. He writes, 19-6-22; "Mr. Voysey's income is very limited compared with the expences. ... The instruments...are very costly. ... His situation as an assistant surgeon in a King's Regiment will subject him to constant changes, having already been in four, and as many times superceded. ...

"I shall add his great application of late to practical mathematics, in which he has made such progress as to be eminently useful...without any hinderance to his own professional avocations. ... I...request that he may be appointed as Assistant on the Great Trigonometrical Survey of India, and receive the usual salary of six hundred (600) sicca rupees per mensem in addition to his allowances as surgeon and geologist [265, 268, 326, 352].

"Had I not been assisted by him when I was at Ellichpoor [8, 232], I should have lost a season, ... a dead expence to Government, overbalancing the amount of many years additional income to Mr. Voysey"[6].

Voysey appealed against Govt.'s refusal; "I have never drawn the allowances of Assistant Surgeon, my sole receipts exclusive of the salary of Surgeon and Naturalist to the Survey being sa. Rs. 80. I have been at considerable expence for necessary instruments and books, for which I have received no remuneration, and I have taken several journeys...when the survey has been in quarters at Hyderabad, for the sole purpose of collecting materials for a geological map, and with no other assistance than my own means afforded, viz., 680 Rs. per mensem. ...

"I have been frequently employed by Colonel Lambton in various surveying operations, not at all coming within the sphere of my duties as Surgeon and Geologist. ... In the course of my present long and expensive journey [Hyderabad to Calcutta]...I have had, and shall continue to have, many

[1] John Ross having d. 15-2-18 [225, 499]. [2] Robt. Jamieson (1774–1854); mineralogist; *DNB.*; Dr. John MacCulloch (1773–1835); geolgt. to OS. 1814; Presdt. Geol. Soc. 1816–7; FRS. *DNB.* [3] Tom Sheridan (1775–1817) Colonial Treasurer, Capetown; son of R. B. Sheridan (1751–1816), playwright; both *DNB.* [4] cf. Mackenzie's paper, *As R.* V. (303–14). [5] DDn. 92 (155, 162). [6] ib. (231–3); 171 (123–4), 19-6-22.

opportunities of increasing my geological map, and of perfecting my barometric sections [266, 467].

"My duties as Surgeon, in the meantime, are performed by my Assistant, under the friendly care of a surgeon resident at Hyderabad, and will be resumed by me when I rejoin. ... Should, however, His Excellency...think the duty of Surgeon incompatible with those of Geologist and Assistant Surveyor, ... my duties as Surgeon may cease, and be replaced by those of Assistant to the Trigonometrical Survey"[1] [402, 445].

Govt. was firm in refusing to allow the double pay, but granted him "an extra allowance on account of ...travelling expences during...deputation...from the headquarters of the Survey, Rs. 200 per mensem"[2]. They were equally firm in refusing a later appn. made by Everest [265], and this time Voysey insisted on resigning, "in consequence of a most urgent necessity of visiting England on important private affairs". ... I have never been successful in obtaining an appointment to the Honorable Company's Medical service, and therefore I have no right to...furlough. He asked, however, that if he should get such appt. "on...return to India" his services in the GTS. should not be forgotten[3] [9, 245, 444].

He left Ellichpur 6-1-24, and travelled via Nāgpur, and then by Jackson's new road to Midnapore [27-8, 462], but he had been sick when he started, and died on the way "being brought dead in his palkee to the Howrah *ghāt*, in a state which showed that he must have died nearly 24 hours previously. The date of the commencement of his fever is noted in his journal". He passed through Sambalpur on March 11th—Saraikela, April 6th—He had crossed the Subarnarekha when his journal closed, April 12th.

Another account says that "he was taken ill at Coliapal, a little to the west of Jehanabad, about the 14th inst. On the 16th he appears to have reached Captain Wilson's tents[4] at Nootan Ganga, and he proceeded for Calcutta on the evening of the 18th. The malady had, however, become so violent that he expired in his palanqueen before the bearers arrived at Sulkia Ghat at two o'clock on the 19th instant".

We are told that "he had...a very correct acquaintance with Hindoostanee, some knowledge of Sanskrit, a familiar insight into the characters and habits of the natives of India, and considerable conversancy with their history and superstitions". Besides his official papers were one on diamond mines of S. India, and another on the stone used in constructing the Tāj at Agra.

"It was his design to have given a map and description of geology of the extensive districts in the Deckan, and along the Godavery and Nerbudda through which he travelled [266]"[5]. He had gained a wide reputation, and Stirling (15 n) quotes him as reporting on " an extensive " colln. of specimens from Cuttack.

His major prof. reports were submitted, the first in 1819, and the second dated 28-6-20, and were pub. by ASB. in 1833.[6] Extracts from his private journals of 1818 and 1819, of geol. interest only, were not pub. till 1850. "After his death his manuscripts came into the possession of the Asiatic Society, and his relatives in England had consented that they should be arranged and published by the Society. This was, however, delayed for many years following the protest of Mr. Havell[7], the professional artist, who had given Dr. Voysey 'a few hints in sketching', and made some drawings for him and demanded some compensation".

The geol. specimens collected up to the time of his death were all brought into the museum of ASB. at Calcutta. In 1841 the Curator reported that he had found " three more of Dr. Voysey's notebooks amongst the papers of Mr J. Prinsep", and again, 19-7-42, " Having examined attentively the five books of Dr. Voysey's notes, there is in them much geological information of the very highest interest". It was further found that with Voysey's report of 8-8-21 (BPC. 21-8-21), he had forwarded a geol. map, that had been passed to the Directors. Ref. was made to London, and the map which covered part of the country between the Godavery and the Kistna was sent out to the ASB. It could not be found for the centenary celebrations of the Geol. Svy. of 1951[8].

WADE, Claude Martine. Ben. Inf. b., Bengal, 3-4-1794. d. 21-10-61, Queen's Sq. Bath ; MI. Bath Abbey.

Ens. 20-7-12 ... Bt. Lt Col. 23-7-39 ; ret. 1-5-44 ; Hon. Col. 28-11-54.

Son of Joseph Wade, Lt Col. Ben. Inf., and Maria Anne his wife ; named after M Gen. Claud Martin, of Constantia, Lucknow (I, 353-4)[9].

m., Bath, 7-8-45, Jane Selina, dau. of Thos. Nicholl, Ben. Art.

Kt. ; CB. ; both awarded 1839.

DNB. ; *DIB.* ; *Oriental Club.* ; *IO Tract.* 216 ; Hodson IV (362) ;

DDn. 191 (323), 17-8-21, appd. to officiate as ASG., Calcutta ; extended till Sept. 1822, SG. writing, 19-12-21 ; "I have derived much useful assistance of from the exertions of Lieut. Wade, who...has been employed in various...duties, ... but particularly" in preparing journals and fdbks. for CD. [292, 309]"[10].

1831-4, with asstce. of Nathl. Hodges as survr., mapped Sutlej R. from Ferozepore to junction with Indus at Mithankot ; MRIO. 160 (4-5).

From 1823, Diplomatic Agent at Ludhiāna, responsible for contact with Ranjit Singh. Conducted negotiations which led to Afghān war of 1838-9 ; comdd. column that forced the Khyber and occupied Kābul, 1839.

1840-44, Resdt. at Indore and PA. Mālwa.

WALKER, John, junr. Cartographer. b. 1787. d. 19-4-73.

Eldest son of John Walker, senr., engraver and cartographer, who had worked privately for Alex. Dalrymple [I, 330-1], and officially under him at Admiralty from 1796 ; "name given to an Arctic cape. He left the Admiralty in 1831, and d. 26-7-31, leaving 4 sons, John, Michael, Thomas, and Charles, who all followed their father's profession".

Markham (405-6, 432) ; Dawson, I.

1825 ; pub. large map of India.

From 1825 John Walker, junr., undertook production of the sheets of Indian Atlas, ¼-inch scale, and completed by 1868 a total of 84 from material sent home from India [286, 295-6]. Produced many other maps, and from 1836, succ. Horsburgh as Hydrgr. [74, 434, 462].

Markham writes that "the amount of judgement and ability he brought to the great task is shewn by the often disputed, but ever approved, excellence of his work ; and there has always been the highest testimony to the accuracy and excellent style"[11].

Dawson notes that he "was the depository of official traditions at the India Office extending over half a century,

[1] DDn. 64 (104), 25-9-22. [2] BGC. 26-9-22. [3] DDn. 205 (4), 1-1-24. [4] John Wilson (1788-1844) ; Ben. Inf. 1808-44 ; with Hill Bildars 1823-5. [5] *As J.* XVII, Jan. 1824 (49) ; XVIII (591). [6] *JASB.* II, June 1833 (298). [7] Wm. Havell (1782-1857) ; with Amherst's mission to China, 1816 ; India 1817-25, *DNB.* [8] *JASB.* X, 1841 (415) ; XI, 1842 (864, 892) ; XIII, 1844 (853-62) ; CD to B (Pub) ; 1-11-43 (30). [9] Hill (129). [10] DDn. 196 (175). [11] *Ocean Highways* (81).

and his well-stored memory frequently proved of great value to his successors".

WALPOLE, Henry [II, 448]. Mad. Inf.
b. Lisbon, 2-10-1787. d. 29-1-54.

Lieut. 21-9-04 ... Col. 18-4-42; comdd. various bdes., Madras Presdcy., 1841-52.

SG. India, 1829-30.

Son of Hon. Robt. Walpole, HM. Envoy to Portugal, and Sophia his 2nd. wife.

m., Madras, 21-8-34, eldest dau. of Maj. C. F. Smith, Mad. Est.

1805, MMI. cl. I [II, 320]; 1811-5, Asst. Instr. at MMI., then taking furl.; MMC. 19-6-19, permitted to return.

1818-20, Mackenzie tried without success to secure his services for svy. [341]; MGO. 1-7-23, sick leave to England, arriving 2-12-23.

1829, largely owing to Troyer's support, Bentinck selected him to be SG. and he assumed office at Calcutta as Maj., 30-10-29 [301, 310, 342, 458], handing over to Everest 8-10-30 [407].

Later, MS. to Govr. Madras, and bde. comdr. Palaveram.

WARD, Benjamin Swain [II, 448-9]. Mad. Inf.
b. 1786. d. Cape Town, 19-6-35; MI. St. George's cem.

Ens. 27-8-08 ... Maj. 21-2-34.

Son of Francis Swain Ward, Mad. Inf., artist, who d. Negapatam, 4-3-1794.

m., Capetown, 24-5-25, Johanna Regina, aged 16, yst. dau. of late Johan Christian Disandt. of Halle, of Saxony, by his wife Maria, dau. of Carel Fredk. Geere, formerly of Hamburg, and wid. of Carel Bestendig.

Appce. at Obsy. survg. school, 22-11-1798 [II, 352]; to Mysore svy. April 1801 [II, 344]; sub-asst. from Sept. 1805; March 1809 to Oct. 1810 on svy. Ceded Dists. [II, 153-4].

MGO. 31-7-10, admitted "Cadet of Infantry", his comn. being subsequently antedated.

ib. 12-3-11, posted to SGO., Madras, for ch. of drawing office [II, 303; III, 105, 339, 465].

Feb. 1816, appd. to ch. of Travancore Svy.; leaving Madras 13-6-16, arrd. Dindigul 14th July to close that svy. and pick up survrs.; 16th Aug. arrd. Travancore [4, 94, 105, 474-5, 508].

Travancore was an exceedingly hilly country, covered with tropical jungle; extracts from Ward's letters to Mackenzie tell of some of his troubles [106-9];

15th Jan. 1817. My legs are very sore & considerably swelled, owing to the bites of a species of tick among long grass near water; so very small, they can only be observed when crawling on the surface of the skin".

5th. Feb. "My legs were in a bad way; they continue to be more painful, and the sores gradually increase, both in size & number. I begin once more to be alarmed. Should they become worse, I will...go to Trivandrum for medical advice, when I fear I may be detained, much to the disadvantage of the Survey, which is by no means getting on well".

2nd. March. "My legs, tho' they have been very bad of late, are now...almost well, with the medical assistance I have received".

2nd May. Reports that many of his assts. are sick with fever; "From hence I proceed north with the triangles, & then s.w. towards Quilon. ... I went in there for a day on the 4th of last month...with regard to a house I purchased for my accomodation during the rains, in the compound of which I am building a large temporary...office. ... I waited on the Resident to request he would allow me a further number of peons, as I find these are the most useful people" [109].

18th. June. When I was at Coutallum last year I had no conception it was a place of very great antiquity. ... I am almost certain you will be highly pleased were you here [at Kuttalam]. The climate is so delightful, & the country beautiful all round, & such a number of curious Hindoo buildings & inscriptions, that your time will be perfectly occupied, & above all, I think it would be of the utmost service to your health [II, 144]"[1].

During the height of the rains he was called off to svy. the disputed boundary with Tinnevelly [107-8]; Riddell writes, 26-11-17; "There has been a story of Ward's having been killed by a wild elephant [108]. I disbelieve it entirely because *I have no report from Aikin, the assistant along with* him, and because Peter [Conner], who has been frequently heard from since that time, makes no mention of it. Should the rumour...be well grounded, I shall direct Conner, who is on his road thither, to take charge of the survey. ... I think there can be no truth in it"[2].

Mackenzie hoped "the story about Ward is not true; his being sent on that business at the time I never approved of. ... As far as I could understand it was suggested by Captn. Blacker; I think he told me so himself here [107-8]. I hope, however, poor Ward has escaped. It would not be the first time, as he & I fell in with wild elephants more than once on the survey of the limit with Wynaad, [in 1804-5; II, 107; III, 108], but they were drove off by lights[3].

The danger from wild elephants is a very real one to lonely survrs. to this day, but could no doubt be exaggerated, and a para. from *Rules for Bombay travellers through Malabar to the Neilgheery Hills*, dated 1840, reads; "A very general practice prevails here of natives attempting to frighten travellers by reports of wild elephants, etc., in order to induce the traveller to hire them as a guard. If their trick succeeds they accompany the palkee, shouting out and firing off guns now and then to show their valour, and thereby prevent the traveller from sleeping all night. There is not the slightest danger from elephants who but very seldom cross this road, and when they do always make off directly they see a light or hear the noise of bearers"[4].

Conner joined the svy. at Quilon, 22-12-17, to work under Ward's direction, though senior in army rank [340]. In describing their interview with the Resdt., 5-1-18, Riddell thought Conner would be better able to state the Survey case, as Ward was "too unobtrusive" [408, 433].

The following extracts are taken from Ward's most interesting *Memoir of the Survey of Travancore and Cochin* pub. 1891[5] [106 n.4];

15th. Jan. 1819. "On gaining the summit the guide deserted. There being several paths, ... on running down a slope I happened to fall into a pit covered with grass and brushwood to catch elephants. My hands fortunately having come into contact with two of the supporters broke my fall, otherwise I should have been severely hurt".

17th. Nov. "Calculating triangles, allotting and pointing out to the Assistants the portion...to be done by each during the next month".

The journal closes 23-2-20, but he writes to Mountford, 27-6-20; "I am myself far from being well, as you may perceive from this scrawl. My legs are at present covered with sores...of a very painful nature. ... A few days ago, having...been exposed when in bed to a bleak morning air, my right side has become affected, leaving me scarcely the use of my hand or leg, and deprived of sleep makes me quite

[1] DDn. 156 (197-214). [2] DDn. 151 (77). [3] DDn. 156 (312), 23-12-17. [4] *Bo Cal & Alm.* 1840. [5] Mad. Govt. Press.

low-spirited. A change for a few days, however, will, I hope, restore me to my usual health and vigour.

"Many thanks, my dear Mountford, for the purchase of Gibbon's Works[1] and, if you can add to it a splendid new edition of Buffon's Natural History[2], I will be very thankful. Dispense with the powder, having procured some. ... You will hear again from me in a few days. I am quite tired, therefore excuse this scrawl"[3].

On Garling's death Mackenzie offered him the Hyderābād svy.—"He is first on the list"—but Ward preferred to remain in the south, and Conner was sent up to Hyderābād [340–1, 433].

On completion of the Travancore svy. Ward moved his party to Dindigul, which was again found to be extremely unhealthy [111, 401–2], and he asked for 6 mo. leave from 1–9–21 "to visit the Western Coast on his private affairs". The leave was postponed as it was hoped that work on the Nīlgiri plateau would set him right, but "his health had suffered so much from the fever contracted on the Dindigul hills, ... that he left for the w. coast on 2nd Dec.[4].

He was back at Coimbatore by 14th March, and made an excellent job of the Nīlgiri Hills [111–3, 375], though in 1823 he was "compelled to run to Trichinopoly for medical advice. ... His complaint (termination of blood to the head) has been checked at the date of his last letter, and he looked forward to an early return to his labours"[5].

After starting work in Malabar he had to take long leave on mc. He sailed from Cannanore, 5–11–24, for the Cape, where he married. Arrd. back in Dec. 1825, landing at Cochin on 9th; left his wife at Tellicherry, and resumed ch. of the svy. 16–1–26 [114, 375–6].

From 1–9–28, granted personal allce. of Rs. 175 as had been sanctioned for Garling several years earlier[6]. His claim was strong; "While on survey in Travancore in 1818...I applied to Colonel Mackenzie...that I may receive the same surveying allowances as those granted to the late Captain Garling. ... This extra salary...was sanctioned in November 1820, ... but which I was only permitted to draw for stated periods while on the surveys of the Cardomum Mountains, the Cheragherry Range, and, latterly for the... Neelgherry and Koondah mountains [320, 350–1][7].

"During the latter survey my health suffered materially from exposure, and I was under the necessity of proceeding to sea. ... In December last I returned to...Malabar. Over the northern portion...triangles have been extended under great disadvantages owing to the very woody nature of the country in the interior. ... To clear the summits of many of the hills...the hire of...coolies...was...a serious expence"[8].

Survey in Malabar was just as unhealthy as in Travancore, and Montgomerie writes, 7–11–29; "Captain Ward's health and constitution have for a length of time past been so much impaired that I do not conceive it possible that the valuable services of that officer can be much longer continued in the Department"[9] [440]. In spite of this he took his party to Madura in 1830, and then to Trichinopoly, and remained in ch. till 1834 when, on gaining his majority, he had to leave the dept. [342]. He then resd. his comn. and ret. to South Africa, where he died the following year.

WATKINS, Hutton. Ben. Inf.
b. 21–12–1789. d. Kālpi, 18–11–18.

Ens. 13–11–05; Lieut. 17–9–08.

Son of Thomas Watkins.

m., 21–10–14, Maria, dau. of Lt.-Col. Wm. Henry Cooper, Ben. Inf.

Hodson, IV (399–400).

1817–8, Marātha War, April–May 1818, MRIO. 81 (46), survd. routes of dett. of fd. army, Kunjauli to Khimlāsa, 30 m. N. of Saugor.

WEBB, James Taylor. Mad. Inf.
b. 23–1–1790. d. 4–8–36.

Ens. 6–4–10 ... Capt. 8–9–26; inv. in India, 15–2–33.

Son of John Webb, of Carmarthen; bro. of John James (1788–25), also Mad. Inf.

March 1810, MMI., cl. v [II, 321].

MGO. 4–5–27, appd. asst. survr., and posted to ch. of Hyderābād Svy., which he held till July 1829, when he took leave to England on mc. [5, 119, 209, 342].

WEBB, William Spencer [II, 453–4]. Ben. Inf.
b. 21–12–1784. d. 4–2–65.

Ens. 20–11–01 ... Capt. 9–12–18; ret. 29–6–24.

Son of William and Mary Webb.

Oriental Club. Hodson, IV (416–7).

1808, explored upper Ganges to within 40 m. of Gangotri, and up to Badrīnāth temple [II, 73–7; III, 33]; 1808–12, on svy. of E. Oudh and Gorakhpur [II, 33–4]; 1812–4, furl. on mc., spending some time at Greenwich obsy. [II, 453–4; III, 44, 175].

BGO. 23–3–15, appd. to svy. Kumaun, completing by Dec. 1821 [29, 32, 44–8, 177, 293, 346, 356, 457, 460]. His particular interest was to fix position and height of snow peaks from stations fixed by triangles and barometer heights [198, 212, 222]. He had corr. barometer obsns. regularly from Calcutta [205], and sent botanical specimens to Dr. Wallich at the Sibpur Gdns.

He acknowledges "a copy of a meteorological diary from Oct. 1st to Feb. 16th 1818, which Colonel Hardwicke...has been good enough to communicate. ... The journal closes, unfortunately, in the very middle of a period when it's aid was most required, as a series of barometrical observations were made at Kasheepoor, beginning 1st, and ending on 21st of the same month [Feb.], from which I propose to deduce the *first station* of my survey". Webb's own barometer obsns. had first commenced on 1–4–17.

He asked for an asst.; "I am absolutely in a state of banishment; it is now half a year and upwards since I have seen a European face, and but for correspondence I should run no small risk of forgetting my own language"[10]. He was given the assce. of Alex. Laidlaw for geol. research, in the expectation that the Himālaya would prove rich in mineral wealth; but Laidlaw's work produced nothing of value [266–8, 367]. An asst. survr. named Tate was helpful only as dmn. [329, 356, 367–8, 506].

Webb's first reports of the height of the mountains produced a storm of criticism from Europe, which he met, with support from the ASB., by giving particulars of his obsns. that proved the soundness of his methods and the truth of his results [2, 46–8].

[1] *Decline & Fall of the Roman Empire;* Edward Gibbon, 6 vols. 1776–88. [2] 44 vols. pubd. 1749–1804. [3] DDn. 149 (128 C). [4] from Mountford, 20–11–21 DDn. 192 (287). [5] from Mountford 29–9–23, DDn. 200 (190). [6] MMC. 21–10–28, DDn. 222 (34). [7] DDn. 463 (377–80), 11–10–20 & 20–3–22. [8] DDn. 218 (233–4), Cannanore, 21–8–26. [9] DDn. 236 (145). [10] DDn. 150 (2), 22–6–17.

Of the many versions of Webb's maps of Kumaun [48 n.5], MRIO. 25 (13) shews his route Almora to Ruderpoor of 1808 [cf. II, pl. 9], and MRIO. 28 (30) is an original by himself or Tate of 1819 [III, pl. 6], and shews the snow peaks [48 n.6].

He was much offended, just as Williams had been [280, 300, 322], at the selection of Hodgson to succ. as SG., and he wrote direct to Govt., 18-6-21, resng. his post "so soon as the business allotted for the present rainy season shall be completed, and the map of the survey be ready for delivery, which I expect will be accomplished by November next, or December at farthest.

"Fully aware that seniority alone does not give a valid claim...I should not...allude to my recent supercession by an officer who has not been a surveyor...one half the time which I have, did not that arrangement—besides the total destruction of my hopes ever to become Surveyor General —appear to attach some stigma to my professional character. ... It is now almost fourteen years since I became a surveyor. ... I have never been absent except on account of sickness. ... I have at all times endeavoured to execute my task skilfully and diligently"[1]. His resn. was accepted, but his comments severely rebuked.

BGO. 25-10-21, allowed leave to the Presdcy. to prepare for leave to Europe; DDn. 195 (180), SG. reports, 21-1-22, that Webb had "arrived at the Presidency and delivered to me his map and field books...up to the 31st December last, at which period...the Kumaoon survey was closed". Webb then reported to Govt., 2-2-22, that he had disposed of "all my surveying apparatus (except 6 barometers and 1 sextant)", and was on the eve of embarkation.

WESTON, Charles Thomas Gustavus [II, 454]. Ben. Inf.

b. 13-11-1786. d. Calcutta, 27-5-28, of cholera.

Ens. 25-10-07 ... Capt. 1-5-24.

Son of Charles Gustavus Weston, of New Clement's Inn.

m., Chunār, 23-12-23, Miss Charlotte Jane Arnold.

Hodson, IV (432).

MRIO. 172 (2), survd. Chilka Lake 1812 [II, 12 ; III, 19]

BMC. 9-2-16 (57), baggage master to Ochterlony's column on Nepāl Frontier, Feb. to April 1815; 1816, Adjt. Rangpur Batt. hdqrs., Titalia[2].

BGO. 21-2-17, survd., Dec. 1816 to June 1817, area ceded by Nepāl, on which—notes DSG. in 1848—"little of the station of Darjeeling can be gleaned".

BGO. 22-7-24, appd. Supt. and Director of Telegraphs, holding post till death [272].

WESTON, Edward. Nāgpur service.

BGO. 8-4-19; Local Ens. 1st Rampura Local Batt. [489]; ib. 13-3-22, "Leave to the Provinces" from 30th April; ib. 17-5-22, disch. from 1-7-22 with gratuity Rs. 1,200.

Local Officer, Nāgpur Service, 27-9-22 to 6-6-30.

Hodson, IV (583).

1823, appd. to svy. under Stewart, but emp. on svy. along Narbada valley to the N., having to break off before May 1824 owing to fever. Large scale svy. of Nāgpur city [91]. 1825, rejoined main svy. under Norris, and emp. on plane-table svy.; 1829, a long time on sick leave; July 1830 to March 1831, with Norris at Calcutta completing maps of the svy., drawing Rs. 500 pm. [92-3].

10-3-31, had booked passage but was still in Calcutta 27-3-31, after Norris had sailed [491]. Had a son born, Calcutta, 16-8-30.

WILCOX, Joshua. Ben. Inf.

b. 15-7-07. d., in India(?) 20-1-59.

Ens. 21-2-24 ... Capt. 24-1-45; Bt. Maj. 11-1-51; ret. 14-2-52; Hon. Lt Col. 29-11-54.

Bro. of Richard Wilcox [*inf*], whose request for him as svy. asst. came to nothing [514].

m., Ludhiāna, 20-9-28, Clarissa Mary Grace, dau. of A. P. Torckler, merch. of Calcutta.

Hodson, IV (465).

MRIO. Misc. 5-0-26; svy. of "boundary between Sirhind & Punjab"; ornamental N. point carries signature "J. Wilcox fecit; 4th Regt. NI. 21st Nov. 1825"; shows routes 100 m. w. from Ludhiāna.

Ben Regr. 286 (134); svy. of "town & country of Loodeanah. 725 yds. to inch, 1826".

WILCOX, Richard. Ben. Inf.

b. 31-5-02. d. Cawnpore, 28-10-48.

Lieut. 7-12-19 ... Lt Col. 13-3-45.

Son of Richard Wilcox, woollen draper in the Strand, and Jane his wife; bro. to Joshua [*sup*].

m., Ghāzipur, 29-7-33, Susan Jane, dau. of Geo. Wilson, of Ghāzipur, and in will dated 25-10-48 left property to his 7 children; one of the executors being his "deceased wife's" bro., Thos. Wilson of Ghāzipur.

Hodson, IV (465).

BGO. 12-9-20, "having passed preliminary examination is allowed 12 months leave from his corps to prosecute his studies at the College at Calcutta"; mil. student at Ft. Wm. Coll., Sept. 1820 to Feb. 1822.

ib. 29-1-24, appd. asst. Rev. Survr., having joined Rohilkhand svy. under Bedford 5-12-23 [154, 332].

ib. 16-9-24, to mil. service in Assam for svy. under Bedford [3, 53, 151, 333, 423]. Arrd. Goālpāra at end of Jan. 1825; emp. with troops, survg. river branches and main tributaries above Jorhāt [54-5, 464] till interrupted by loss of most of his insts. in boat accident [54, 214, 216][3]. He had, however, already attracted the attention of Scott [55-6, 501], who writes privately to Govt., 3-8-25; "Lieut. Wilcox is also very desirous of being allowed to explore the country north of the mouth of the Dewhung. I fear he will not be permitted to do this, or anything else worth notice, whilst under Capt. Bedford, there being some sort of jealousy on the Captain's part [423]. ...

"If I were authorized to employ *any volunteer officer* properly qualified upon this duty, and give him the requisite assistance, Wilcox would go, and I know no one who is likely to make a better use of his opportunities for observation. He is a most intelligent, well-informed, young man, and quite zealous in the cause. Having more than once written publicly on the expediency of exploring these unknown regions, I have not thought it necessary to address you officially on the subject again"[4].

Govt.'s official approval came through the SG. who gave his warmest support [55-6]. Leaving Goālpāra 27-10-25, Wilcox started by exploring the Subānsiri, which he found an unnavigable mountain torrent. He then moved up to Sadiya where he learned that Bedford had already been up the Dihang and been turned back by Abors [54-5, 182].

With Burlton as companion, and armed with suitable gifts, he made several expns. between Feb. and June up the Dihang and rivers round Sadiya, where

[1] DDn. 191 (249-51). [2] 78 B/7; 30 m. W. of Jalpaiguri. [3] *As R.* XVII (316, 321-3). [4] DDn. 230 (M 414).

he spent the rains learning the language and reading all he could find on his subject [56–64, 427][1]. After Bedford's departure he was left a free hand, and in October 1826 he started by himself exploring the Lohit to the east of Brahmakhund, a most difficult journey from which he was turned back by the hostility of the Mishmis [58, 222].

Scott gave his whole-hearted support and recdd. that a second officer should assist him [56–7]. "From the arrangements which Lieutenant Wilcox has made with the neighbouring tribes, I should hope that during the ensuing cold weather he will be able to trace the Dehang far enough either to identify it with the Sanpo, or to refute the generally received opinion as to that river flowing through Assam, and that he will afterwards have sufficient time to penetrate into the Barhampootur, about 80 miles eastward of Suddaya, and which is represented as being inhabited by a civilized tribe of Thibetians"[2].

Wilcox now made another trip up the Dihang with Burlton, with little better success than before. The Abors were definitely hostile to any attempt to penetrate their country. Though he was now more convinced than ever that the great volume of the Brahmaputra water came down their way, he was anxious to visit the Irrawaddy and test the theory that it might be the outlet of the Tsangpo. He and Burlton left Sadiya in April 1827 and worked their way over the formidable range that separates Assam from Upper Burma, and emerged at the small town of Putao, now Fort Hertz, where they found the w. feeder of the Irrawaddy, here called Nam Kiu or Mali Hka, a small fordable river that could not possibly contain the waters of Tibet. They were back at Sadiya 9 weeks after their start, completely worn out and saturated with fever, but triumphant to have disposed of a theory they had never believed in[3] [60–3, 79, 220, 428–31, pl. 7].

Wilcox was shaken in health, but by no means broken in spirit, and being prevented by the Abors from tracing the waters of the Brahmaputra further up the Dihang, he obtained permission to make a more thorough survey of the great river towards Bengal. He writes to the SG., 1–8–27; "It is only the need I have for money (nay, I must say...that while there remained any thing to be discovered I would never leave the field)...that prevents my asking permission to return to my duties as Revenue Surveyor in a more congenial climate. But, in truth, this severe bout of illness has alarmed me, & I cannot help reflecting how many...officers have been cut off in Assam, & I have doubts whether or not I should beg you to send me back to Moradabad—Rs. 100 a month is an object to me"[4] [217–8].

Again, 9–8–27; "I hope you will not take the river survey out of my hands; I am very anxious to perform it", and on the 18th, "My map is not yet begun, and I incur the displeasure of the Doctor...by persisting in...calculations necessary for its construction. ... I hope...I may have the survey between Goalpara & Suddeeya. I feel anxious to perform it because I think I know enough of the higher branches of surveying...to give you satisfaction (though not much of a mathematician)".

Hodgson replied sympathetically; "I will write for authority for your drawing salary during the rains [349]. I think you did well to return to Bishnauth[5], and hope the change will restore your health, and that you will be able to persevere with your works in Assam. I do not think there is any chance of officers being sent back to the Revenue from the Geographical Survey. It was effected with great difficulty in Bedford's instance, but you have a more important part to fulfil, and I hope your health will bear you out. If fever attacks you the only remedy is a sea voyage, I believe"[6].

In spite of ill-health Wilcox was loth to leave Assam. He writes to Hodgson from Gauhāti, 28th Aug.; "I am under some apprehension that I shall not be able to go to work very early in the season. The Doctor threatens me with either a hill or sea trip, if after a few days I do not get *permanently* better. The hill and sick bungalow are near, therefore my choice is settled, but the road is through a jungle, and no bearers but the uncouth labourers of the country. My pulse at this moment is 120 [*sic*] and it is seldom lower. I am also miserably weak in bodily power and in digestive organs. I hope nevertheless to fight it out" [400].

He asks, 28–8–27, that his bro. Joshua [*sup*] may join him as asst., "recommending very earnestly to your notice the elder of my young brothers, who draws beautifully, and is well qualified by education to become my assistant".

7th. Sept.; "Lt. Burlton will leave me, I believe, this month, & I heartily wish I could fill his place by getting my brother as assistant. ... It would be a great object and a comfort to have with me a brother rather than a stranger".

29th. Oct. I...return my best thanks for the interest you...express with regard to attaching my brother to me. He is now at Loodheeanah, and has been in the country about 3¼ years. ... The assistance, even of a beginner, would be of material use in the survey of the river, & transit lunar observations"[7].

He writes to Hodgson who was anxious to get the account of his Irrawaddy journey well pub.; "Neither Burlton nor I shall object to your doing whatever you think fit with the journal [63]. ... I feel it almost a duty to draw up a more formal account of our journey through those wilds, which will not be again visited for centuries perhaps. But it will be a task in earnest for me; I...fear to fail sadly in memoir writing. ... I have now been fighting against diarrhœa & for it taken rest & plenty of stultifying laudanum"[8].

He withdrew to the little bungalow just built at Nongkhlao in the Khāsi hills [64, 431]. "13th. Sept. I start for Nungklow on the 2nd. ... and there I do not propose to be idle, either with the pen or perambulator".

He was interested in the road being made to Cherrapunji, and doubted whether it could ever be made fit for wheel traffic; "I have seen only a small portion. ... I went the greater part of the way from Gowhutty to Nungklow in a closed palankeen when in a weak state of health, and when on my return I was occupied with anxious thoughts about my expedition...to the eastward. ...

"I propose to describe what had been done to make the road as far as Nungklow where the convalescent bungalow has been built. Beyond that place, I believe, it was not intended to carry it. ... So much was done by a very few labourers in the period of my stay there, that there remained no obstacle to riding up the entire ascent, where before it had been impracticable, or at least utterly unsafe [431, 464][9]. ...

The expn. "to the eastward" had to be abandoned; "On the 22nd November, being very anxious to take advantage of an unexpected offer of safe conduct to Moongkhoong[10], made by some envoys from the Shan government, I started from Nong Klow to recover strength and health to fit me for the undertaking, but a severe relapse obliged me to remain under the care of the surgeon at Bishnath, and up to this I have been unable to carry on any other duty than copying

[1] *As R.* XVII (340–50). [2] DDn. 219 (12–4), 26–8–26. [3] Journal, DDn. 226, M 479; *As R.* XVII (412–53); notebook, *IO Cat.* (118–9). [4] Asst. Rev. Survrs. drew Rs. 250 pm. [350]. [5] 20 m. above Tezpur. [6] DDn. 220 (253), 20–8–27. [7] DDn. 224 (65–81). [8] DDn. 214, 7–9–27. [9] DDn. 224 (105–10) 15–10–28. [10] Maingkwan, in Huhkawng valley, 92 B/11.

a few papers". His letter continues from Gauhāti; "I am still suffering for my temerity in venturing thro' the jungles in May & June. Nor am I alone in this, for here I found Lt. Burlton obliged to leave his road-making to seek medical aid (he has been liable to attacks of fever ever since our return). I was so little benefitted by rest & medicine at Bishnath, that Dr. O'Dwyer strongly recommended my proceeding at once for the Presidency, and thence to sea"[1].

It was high time for him to escape from the enervating climate of Assam, repeated reinfection with malaria, and constant temptation to be "up and doing". "My leaving the hills seems to have been a very premature act, causing a complete lose of time, for had I remained there another month, doing well, I should perhaps have been gaining a stock of health to fit me for active duties, whereas I...now suffer under such a deranged state of the digestive organs that...the Surgeon of the station thinks it would be highly improper for me to proceed out of reach of medical aid"[2].

Hodgson was alarmed and asked Govt. to call him down to Calcutta and send him off to sea; "Poor Wilcox...is in a bad way. The wisest thing he could do would be to come down, as a man in such a weak state can only stay to his destruction"[3] [64].

Wilcox started down to Calcutta in Feb. 1828 and, making a svy. of the river on his way, did not arrive till June. After several months in the SGO. working on his map [64, 298, pl. 7] he was granted 5 mo. leave to Batavia from 30-4-29, rejoining 8-12-29. He completed his maps, and then resumed svy. of the lower Brahmaputra, having the asstce. of Ommanney from Oct. 1830 [16, 64, 493].

Accounts of his work in Assam appeared in several contemporary journals, including *Asiatic Researches*, vol. 16. A complete *Memoir* covering 1825 to 1928 appears in *As. R.* XVII (314-469), with a map of NE. Frontier, scale 32 m. to inch [pl. 7].

Served later in GTS. and, from 1835 till death, as Astronomer to the King of Oudh at Lucknow [93].

WILLIAMS, Monier [II, 456-7]. Bo. Inf.
b. c. 1777, St. John's, Newfoundland. d. Naples, 30-11-23; MI.

Lieut. 28-12-1798 ... furl. Nov. 1821; Lt Col. 9-1-22. SG. Bombay, 1807-15.

Son of George Williams, CJ. Newfoundland, and Marie Monier, of Jersey, his wife.

m., Bombay, 28-12-11, Hannah Sophia, dau. of J. T. Brown, of EIC.'s service; father of Sir Monier Monier-Williams (1819-99), *DNB*.

1799-1802, with Pioneers in Malabar, frequently on svy. [I, 132]; 1802-7, asst. to Reynolds, SG. Bombay, at Surat, being promoted to Deputy [II, 323]; and, from 2-3-07, succg. as SG. [II, 306].

On abolition of post of SG. Bombay, Williams protested, without effect, at not being selected to be SG. of India [306, 457]; He even persuaded friends in England to protest direct to India Ho., and on the Directors refusing to consider such irregular appn., submitted a lengthy petition dated 10-6-17; "The surveys...were...continued under the direction of your memorialist in the same manner as before. ... All the officers...continue in the receipt of their former allowances, under your memorialist. ...

"Your memorialist is at present, and was before the discontinuance of his pay as Surveyor General, in receipt of 500 rupees per month as a member of the Revenue Survey Committee" [351]. He went on to ask for "the allowance usually granted to an officer at the head of a survey, from the time he ceased to draw the pay of Surveyor General", and pointed out that he had "nearly completed nineteen years service in India, without having been once absent from duty on account of ill-health; and never on leave but for six weeks in the end of the year 1814, when every officer in the Departt. was disabled by a fever which raged in Goojerat" [280].

He continued as member of the Com. of Rev. Svys., holding ch. of rev. svy. at Broach, and later of Gujarāt, and continuing to act as adviser to the Bombay Govt. on all svy. matters [5-6, 122, 131, 169-70, 292, 321-2, 343]. Besides his rev. svys. his most important fd. svys. had been those of Gujarāt carried out during 1809-10 [II, 170-3], and svys. of the Ghāts and the Atavisi to the E. of Dāman, made in 1816 [122-3]. Took particular interest in preparing a revised edn. of Reynold's great map, which he completed in 1821 [II, 284-5; III, 279-80].

In 1820 he called attention to his memorial of 1817, "I was not honored with an acknowledgement, ... and, as no answer... has yet come from England, even by the late arrivals, I am apprehensive that it was never transmitted. ... That the duties of Surveyor General were important is acknowledged. That they were discharged by me with advantage to the public service, I appeal to the records. ... These duties have been continued unaltered in my hands up to the present day. ... In addition to these I have been employed on two Missions, one to the petty state of Aungria, and the other to that of Mandvee, but without receiving or desiring any reward.

"Captain...Sutherland...has since met with great advancement; six other officers...were also continued on a footing quite unaltered. ... I alone have suffered...loss".

He was thereupon given authority to proceed by sea to Calcutta on duty, with a copy of the great map, and represent his case in person to the Supreme Govt. He suggested that he might obtain further map material from the depots at Madras and Calcutta, and that the Directors might allow him to continue work on it after his return to England[4].

By the time, however, that the map was ready, news came of Hodgson's nomination to succeed as SG., and in disgust Williams abandoned his visit to Calcutta [280, 300].

The map was sent without him, with an appreciative letter from Bombay Castle; "At the inspection of it, previously to its being packed for Calcutta, the Governor in Council was struck with the carefulness, distinctness, and beauty of the execution, and he trusts that Major Williams will be considered as entitled to the approbation of His Lordships in Council for having brought so extensive and valuable piece of Geography to a completion. ... Major Williams has superintended the execution of the work gratuitously"[5].

He pressed again for special allces. as head of the Survey, and for refund of actual expenses [322]. Govt. agreed that an allce. of Rs. 80 pm. should be granted for the cont. expenses of the last 6 years, and recdd. to the Directors that he should be given a special salary equal to that of the ASG. at Madras. After long delay the Directors authorized an additional allce. of Rs. 200 "from the period of the abolition of the office and salary of Surveyor General".

He insisted on his resn. and the following appreciation was issued from Bombay Castle, 17-11-21; "The Hon. the Governor in Council permits Major Monier Williams, ... Superintending the Revenue and

[1] DDn. 224 (87), 1-1-28. [2] DDn. 214, 15-12-27. [3] DDn. 2[illegible] (7[illegible]), 14-1-28. [4] from Williams 15-11-20. Bo MC. 352/1820. [5] DDn. 191 (345), 26-7-21.

Topographical Survey of Guzerat, to resign that situation, and to proceed to England on his private affairs [322, 343, 435]. ...

"The Governor is happy to bear testimony to the extraordinary zeal and ability manifested by Major Williams in the course of the survey, ... the result of which has afforded ...a great body of authentic and valuable information. ... Independent of the immediate duties of his office, the Governor in Council has been frequently indebted to the public zeal and geographical knowledge of Major Williams"[1].

WOTHERSPOON, William. Mad. Engrs.
b. 13-8-1793. d. nr. Nāgpur, 15-1-17; MI. Sītābaldi cem.

Ens. 27-7-11.

Son of John Wotherspoon, merch. Glascow, and Jean Gross his wife.

Crofton, I (3).

Oct. 1816, with Doveton's force on svy. of passes E. of Wardha R. [83].

WRIGHT, Charles Robert. Bo. Inf.
bapt. 3-3-02. d. Poona, 13-4-20.

Lieut. 5-1-19.

Son of Capt. Charles Wright, comdg. a cadet co. at RMC., and Harriet his wife.

DDn. 145 (171-4), 4-2-20, asst. on Deccan Svy. [125-6].

WROUGHTON, Robert. Ben. Inf.
bapt. 3-8-1797. d. Fatehgarh, 14-2-50.

Lieut. 1-8-18 ... Maj. 29-7-48; inv. 31-7-49.

Son of George Wroughton, formerly attorney of Calcutta, Comdt. of Wakefield Local Militia, and Diana his wife; bro. of H. F. Wroughton, Ben. Inf.

m., Berhampore, 31-12-19, Sophia Eliza Amelia, dau. of Col. Wright.

ed. Addiscombe, 1813-5; Chatham till Dec. 1816; selected for Engrs. 13-11-15; tr. to Inf. Dec. 1816.

Hodson, IV (533).

April 1818, on svy. of Mātābhānga R. [151-2, 425].

BGO. 19-10-21, appd. Asst. to Rev. Survr., Gorakhpur [151, 333]; ib. 12-2-24, promoted Rev. Survr. in ch. [152, 332, 455]; ib. 16-9-24, Burmese War, to mil. service, joining Arakan force under Schalch [68-9, 151, 333, 435]; survd. route to Arakan capital —distinguished service at capture, 1-4-25—spent six weeks on a svy. of city—Mentioned in dispatches [181-2, 199].

"To Lt. Wroughton of the Survey Department I am particularly indebted, not only for the reconnaissance he made when we neared the enemy, but especially for discovering the paths by which Brigr. Richards with the column under his command gained the right of the enemy's position".

After the night attack, "at ½ past 11, the appointed rocket signal was thrown up, and Lieut. Wroughton...returned from the height, bringing the grateful intelligence that, tho' the fire of the enemy had been heavy, the stockade had been gained without a man on our side being killed"[2].

June to Oct. 1825, on sick leave to Benares; Nov., appn. from Barrackpore for tr. from Arakan refused by SG. for lack of mc.; 25-12-25, co. at Cheduba reports; "Lieut. Wroughton, surveyor to the South-East Frontier, having arrived at this island in the brig Brangham. This vessel...was bound to Arracan, but in consequence of the late severe gale was driven in here in distress, having lost her masts. Lieut. Wroughton has not been able to leave his bed since his arrival here, and still continues in a precarious state. ... I...enclose a medical certificate"[3].

28-1-26, reports return to Barrackpore. BGO. 17-2-26, re-tr. to Rev. Svy., to resume duty at Gorakhpur [160, 165, 299, 365, 370, 388-9, 474].

Oct. 1830, after promotion to Capt. and close of Gorackhpur svy., reverted to regtl. duty at Muttra [152, 213, 334, 342]; re-emp. on svy. April 1832.

1844-7, DSG. and Supdt. Rev. Svys. Bengal.

YOUNG, Robert. Mad. Inf.
b. 2-8-1789. d. Masulipatam, 2-7-23.

Ens. 1-1-07 ... Bt. Capt. 28-3-21.

Son of Rev. David Young, minister of Foulden, co. Berwick.

m., Madras, 9-9-19, Mary Haslewood [*sic*], pr. dau. of Col. Joseph Haselwood [II, 466].

June 1807, MMI., cl. III [II, 320]; MGO. 3-8-09, sd. discipline "test" of White Mutiny [II, 314]; resd. from MMI. 21-1-10, on account of ill-health.

MMC. 22-1-11, as Adjt. 25th NI., leave on mc. to sea "having for a length of time laboured under severe attacks of fever, with an affection of the liver"; MGO. 6-10-12, to Europe on mc.; again 31-8-16; CD to M., 29-5-18, permitted to return; 1819, with Hyderābād Subsy. Force.

DDn. 149 (152), 12-10-20, recdd. by Col. Haselwood for empt. on svy., "well qualified...mathematics and drawing" [341]; MGO. 11-5-21, to ch. of Hyderābād Svy. after Conner's death; delayed by duty as actg. pymr. to Nāgpur Subsy. Force; left Nāgpur 4-12-21, assumed ch. of svy. at Hyderābād 28th Dec.; 16-8-22, allce. increased from Rs. 350 to 575 pm. [117-8, 320, 350, 417-8].

DDn. 200 (75), 30-5-23, "compelled to leave the field of survey on the 4th March, from a sharp attack of the liver; June 1823, granted 5 mo. leave to the coast; "a fever and liver complaint contracted on the mountains near Perwuttum [509] terminated his existence on the 2nd July last at Masulipatam, to which place he had proceeded on the advice of his medical attendants"[4] [5, 342].

[1] *As J.* XIII, 1822 (618). [2] *Govt Gaz.* 14-4-25. [3] DDn. 213 (90). [4] from Mountford, DDn. 200 (222), 27-11-23.

CORRIGENDUM

Page 482, col. 2, lines 22-3, *for* has been described *read* was first examined, 1835-6 *and after* Harkness *for* Sec. *read* at the request.

ACC. No. 7951 EGMORE, MADRAS-600 008

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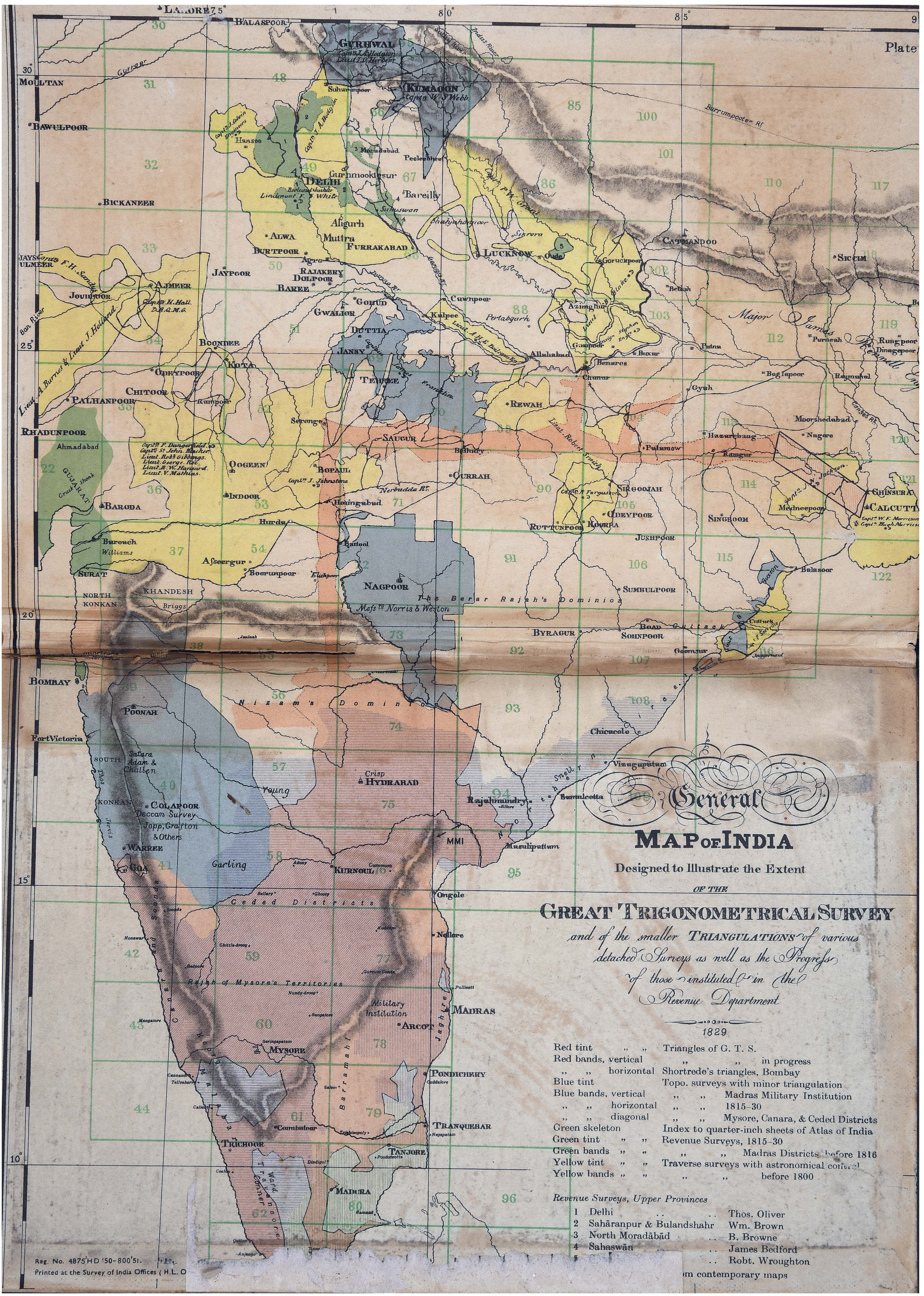

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